

101971

APPENDIX A

Final Data from Soil Investigation

Southern Maryland Woodtreating Site

Hollywood, MD

February 4, 1994

AR302421



GSA RARITAN DEPOT  
2890 WOODBRIDGE AVENUE  
BLDG. 209 ANNEX  
EDISON, NJ 08837-3679  
908-321-4200 • FAX: 908-494-4021

DATE: June 24, 1993

TO: Harry Allen, U.S. EPA/ERT Work Assignment Manager

THRU: Gary Buchanan, REAC Section Chief *R. Henry for GB*

FROM: Mary Lee Caruso, REAC Task Leader *Mary Lee Caruso for MLC*

SUBJECT: SOUTHERN MARYLAND WOODTREATING, HOLLYWOOD, MD  
WORK ASSIGNMENT #5-670 - STATUS REPORT III

#### BACKGROUND

The Southern Maryland Wood-Treating (SMWT) site is located in Hollywood, Saint Marys County, Maryland. The site is comprised of approximately 25 acres in the northwestern portion of a 96-acre property and is surrounded by residential and agricultural areas. Wood treatment operations were conducted on approximately four acres of the site.

In August 1992, the United States Environmental Protection Agency/Environmental Response Team (U.S. EPA/ERT) tasked the Response Engineering and Analytical Contract (REAC) contractor to conduct the following tasks:

- o Determine the extent of contamination.
- o Determine the hydrogeology of the site by continuous coring with the Geoprobe.
- o Build four compost piles, two with a 20% amendment addition and nutrients added to the soil and two with no amendments.
- o Construct six land treatment cells using the contaminated soil and the compost sewage sludge found in the land treatment area.

Field work at the SMWT site commenced on August 31, 1992, when the initial site walk through was conducted and continued through the week of September 7, 1992. During the week of August 31, 1992, equipment and material required for the construction of the compost piles were ordered and delivered. Steel sheds were constructed to house the monitoring equipment and the water pump. The monitoring and watering system was set up to monitor the temperatures of the piles and to water the piles, respectively (Figure 1). The compost piles are monitored with two thermocouples and a soil moisture block in each pile, and the watering system is set on a timer to turn on for approximately five minutes each day.

ml\CARUSO\5670-SR

AR302422

## OBSERVATIONS AND ACTIVITIES

Monthly sampling events have been conducted to sample the compost piles and the land treatment cells. To date, samples have been collected through 250 days, and results of the creosote and PCP data are presented in Tables 1 through 10. The results for Days 0 through 180 are validated data and the results for Days 230 and 250 are preliminary data that have not been validated. Corresponding graphs showing non-carcinogenic, carcinogenic, and total creosote compounds for the compost piles and land treatment cells are presented in Figures 2 through 7.

The results shown in Figure 2 indicate that there is slow degradation of non-carcinogenic creosote compounds in all of the compost piles. The carcinogenic creosote compounds shown in Figure 3 indicate that a slower degradation rate is occurring in the compost piles. A graph of the total creosote compounds is shown in Figure 4. The land treatment cells do not appear to indicate any pattern of degradation in the non-carcinogenic, carcinogenic, or total creosote compounds as indicated in Figures 5 through 7, respectively.

During the week of April 26, 1993, another sampling event was conducted to install two groundwater monitoring wells and nine soil borings in the land treatment area. Figure 8 shows the locations of the monitoring wells and soil borings.

Soil samples were collected at five foot intervals from the ground surface to a depth of approximately 40 feet to the silt/clay horizon. Soil samples were field screened with a photoionization detector (HNU) and a flame ionization detector [Organic Vapor Analyzer (OVA)]. All readings taken during sampling were at background levels, with the exception of the soil sample collected at 25 to 27 feet, where the OVA reading was 10 units above background levels. The samples were analyzed for PCP, creosote compounds, and volatile organic compounds. Volatile organic compounds data indicate that the samples were primarily contaminated with trace concentrations of acetone, carbon disulfide, carbon tetrachloride, and methylene chloride. These detected compounds may have been attributed to laboratory contamination. One sample, B-1 (0-2'), indicated benzene (31 parts per billion (ppb)), ethylbenzene (3400 ppb), styrene (1900 ppb) and xylenes (5900 ppb) contamination. Tables 11 and 12 show the results of the PCP and creosote compounds of the soil boring locations. As shown in Tables 11 and 12, contamination was noted in mostly the surface samples of 0-2 feet, and in the depth sample of 5-7 feet at location B-1. The concentration of total creosote at 5-7 feet was 8.4 J mg/kg at location B-3.

The "HICP" samples were samples collected from the highly contaminated stockpile located within the sheetpile wall. The results of these samples are also shown in Table 12. These samples were collected with a hand auger and a stainless steel trowel.

Soil boring samples were collected employing ASTM method D-1586-84/Split Barrel Sampling using a standard two foot long, two inch outer diameter split spoon sampler. The soil sampler was driven by a 140 pound hammer with a standard fall of 30 inches. Blows used to penetrate each six inch interval were recorded.

The wells were constructed of two-inch inner diameter, threaded, 0.010-inch slot, Schedule 40, PVC well screen attached to an appropriate length of two-inch inner diameter, threaded, Schedule 40, PVC riser casing. The monitoring wells were screened 10 feet into the water table to above the clay layer. The PVC riser casing extended two to three feet above ground level. A filter pack of #2 sand was inserted between the well screen and the borehole wall to approximately two feet above the top of the screen. A three foot thick bentonite pellet seal was then added above the sand pack and allowed to hydrate overnight before grouting. A Portland cement/bentonite grout was then added until the remainder of the borehole had been sealed.

The soil boring logs and monitoring well logs are attached as Appendix A. The boring logs show that the lithology of the soils consisted of mainly poorly graded silty sand, varved grey and orange silty clay, and fat clay. Two wells were installed at locations B-6 and B-9. The purpose of installing these two wells was to provide additional information regarding the boundaries of the land treatment area.

#### FUTURE ACTIVITIES

One additional sampling event will be conducted on June 21, 1993 to collect the last round of soil samples from the compost piles and land treatment cells. An interim Focused Feasibility Study (FFS) report will be prepared for the U.S. EPA Region III Remedial Program Manager by the end of June, 1993. The FFS will be completed and delivered to the Region by August 31, 1993.

DRAFT

TABLE 1  
SOUTHERN MARYLAND WOODTREATING SITE  
Results based on dry weight of soil (parts per million)  
COMPOST PILE 1  
May, 1993

COMPOUND	DAY 0 Compost 1	DAY 10 Compost 1	DAY 20 Compost 1	DAY 40 Compost 1	DAY 80 Compost 1	DAY 120 Compost 1	DAY 180 Compost 1	DAY 230 Compost 1	DAY 250 Compost 1
<b>NON-CARCINOGENIC</b>									
Naphthalene	680	32	31	22	24	12	10	10	8
Acenaphthene	650	497	433	357	250	137	46	37	13
Fluorene	620	467	360	287	237	137	120	92	66
Phenanthrene	1600	1053	877	627	540	233	247	167	125
Anthracene	1900	1567	1433	1333	1667	1033	1300	800	790
Carbazole	520	293	227	230	300	197	203	160	130
Fluoranthene	880	800	837	767	910	747	910	610	667
<b>SUB-TOTAL</b>	<b>6850</b>	<b>4708</b>	<b>4198</b>	<b>3622</b>	<b>3928</b>	<b>2496</b>	<b>2836</b>	<b>1876</b>	<b>1799</b>
<b>CARCINOGENIC</b>									
Pyrene	590	490	567	527	603	510	637	443	503
Benzo(a)anthracene	140	127	157	127	140	106	110	87	110
Chrysene	230	170	177	167	263	163	190	130	163
Benzo(b)fluoranthene	68	54	76	70	78	63	62	51	83
Benzo(k)fluoranthene	68	56	75	71	75	71	74	48	80
Benzo(a)pyrene	55 J	47	60	62	67	56	58	44	74
<b>SUB-TOTAL</b>	<b>1151</b>	<b>944</b>	<b>1111</b>	<b>1023</b>	<b>1227</b>	<b>969</b>	<b>1131</b>	<b>803</b>	<b>1013</b>

<b>TOTAL</b>	<b>8001</b>	<b>5653</b>	<b>5309</b>	<b>4646</b>	<b>5154</b>	<b>3465</b>	<b>3967</b>	<b>2679</b>	<b>2812</b>
--------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

<b>Pentachlorophenol</b>	<b>79</b>	<b>73</b>	<b>94</b>	<b>110</b>	<b>110</b>	<b>82</b>	<b>77</b>	<b>87</b>	<b>79</b>
--------------------------	-----------	-----------	-----------	------------	------------	-----------	-----------	-----------	-----------

AR302425

DRAFT

TABLE 2  
SOUTHERN MARYLAND WOODTREATING SITE  
Results based on dry weight of soil (parts per million)  
COMPOST PILE 2  
May, 1993

COMPOUND	DAY 0 Compost 2	DAY 10 Compost 2	DAY 20 Compost 2	DAY 40 Compost 2	DAY 80 Compost 2	DAY 120 Compost 2	DAY 180 Compost 2	DAY 230 Compost 2	DAY 250 Compost 2
<b>NON-CARCINOGENIC</b>									
Naphthalene	710	54	100	48	86	39	29	16	21
Acenaphthene	780	610	550	443	283	320	283	127	170
Fluorene	750	523	413	377	380	310	313	193	207
Phenanthrene	1900	1187	780	867	990	590	660	333	450
Anthracene	2400	1833	1233	1200	1567	1167	1500	970	1333
Carbazole	640	333	207	240	317	263	323	243	273
Fluoranthene	1100	1057	743	720	813	717	883	583	763
SUB-TOTAL	8280	5598	4027	3895	4436	3406	3991	2465	3217
<b>CARCINOGENIC</b>									
Pyrene	710	667	547	490	533	480	577	407	540
Benzo(a)anthracene	170	167	200	113	127	123	106	133	115
Chrysene	230	220	240	143	223	173	187	143	167
Benzo(b)fluoranthene	81	72	84	59	65	68	58	57	83
Benzo(k)fluoranthene	83	73	81	58	63	73	66	54	80
Benzo(a)pyrene	66	65	71	52	57	59	54	50	76
SUB-TOTAL	1339	1264	1223	915	1068	976	1048	844	1061
<b>TOTAL</b>	<b>9619</b>	<b>6861</b>	<b>5250</b>	<b>4810</b>	<b>5504</b>	<b>4382</b>	<b>5039</b>	<b>3309</b>	<b>4278</b>
Pentachlorophenol	58	48	117	82	84	90	89	75	48

AR302426

TABLE 3

SOUTHERN MARYLAND WOODTREATING SITE  
Results based on dry weight of soil (parts per million)  
COMPOST PILE 3  
May, 1993

COMPOUND	DAY 0 Compost 3	DAY 10 Compost 3	DAY 20 Compost 3	DAY 40 Compost 3	DAY 80 Compost 3	DAY 120 Compost 3	DAY 180 Compost 3	DAY 230 Compost 3	DAY 250 Compost 3
NON-CARCINOGENIC									
Naphthalene	390	46	17	6	6	6	7	3	4
Acenaphthene	510	460	423	300	107	84	197	34	50
Fluorene	420	380	367	287	190	167	300	76	100
Phenanthrene	1000	870	910	637	433	317	757	140	197
Anthracene	1300	1300	1100	1020	1097	937	1700	700	1023
Carbazole	340	267	207	207	193	177	157	116	137
Fluoranthene	800	780	673	723	650	577	1030	517	687
SUB-TOTAL	4760	4102	3697	3179	2676	2265	4148	1586	2198
CARCINOGENIC									
Pyrene	550	497	473	513	457	413	723	413	543
Benzo(a)anthracene	120	130	150	113	110	100	136	101	110
Chrysene	170	163	160	150	203	140	250	113	147
Benzo(b)fluoranthene	61	59	66	65	65	55	67	36	76
Benzo(k)fluoranthene	65	60	65	65	61	59	78	45	75
Benzo(a)pyrene	57	50	55	54	53	48	57	39	64
SUB-TOTAL	1022	959	970	960	948	815	1311	747	1015

TOTAL	5782	5062	4667	4139	3625	3080	5459	2333	3213
-------	------	------	------	------	------	------	------	------	------

Pentachlorophenol	76	35	33	21	46	54	77	40	25
-------------------	----	----	----	----	----	----	----	----	----

AR302427

TABLE 4  
SOUTHERN MARYLAND WOODTREATING SITE  
Results based on dry weight of soil (parts per million)  
COMPOST PILE 4  
May, 1993

COMPOUND	DAY 0 Compost 4	DAY 10 Compost 4	DAY 20 Compost 4	DAY 40 Compost 4	DAY 80 Compost 4	DAY 120 Compost 4	DAY 180 Compost 4	DAY 230 Compost 4	DAY 250 Compost 4
<b>NON-CARCINOGENIC</b>									
Naphthalene	140	5	4	5	3	5	3	2	3
Acenaphthene	310	165	240	187	127	141	77	84	118
Fluorene	220	129	190	167	129	147	89	86	117
Phenanthrene	510	283	360	340	287	267	280	190	260
Anthracene	810	720	683	713	610	643	790	503	657
Carbazole	150	103	125	122	121	120	85	91	109
Fluoranthene	560	493	537	513	377	420	573	360	433
<b>SUB-TOTAL</b>	2700	1898	2139	2046	1654	1743	1897	1316	1697
<b>CARCINOGENIC</b>									
Pyrene	390	333	387	373	320	330	450	293	340
Benzo(a)anthracene	88	84	99	82	84	83	70	59	76
Chrysene	130	117	117	113	157	113	130	86	113
Benzo(b)fluoranthene	53	45	52	53	54	48	45	38	57
Benzo(k)fluoranthene	55	45	52	50	51	52	57	37	56
Benzo(a)pyrene	47	37	42	41	43	41	40	31	48
<b>SUB-TOTAL</b>	764	661	749	712	709	667	792	544	690
<b>TOTAL</b>	3464	2559	2888	2758	2364	2410	2689	1860	2387
Pentachlorophenol	53	19	22	28	28	41	33	26	14

AR302428

DRAFT

TABLE 5  
SOUTHERN MARYLAND WOODTREATING SITE  
Results based on dry weight of soil (parts per million)  
LAND TREATMENT CELL 1  
May, 1993

COMPOUND NAME	DAY 0 LTC1	DAY 10 LTC1	DAY 20 LTC1	DAY 40 LTC1	DAY 80 LTC1	DAY 120 LTC1	DAY 180 LTC1	DAY 230 LTC1	DAY 250 LTC1
<b>NON-CARCINOGENIC</b>									
Naphthalene	110	244	35	115	86	302	13	92	7
Acenaphthene	73	253	357	327	191	353	126	203	104
Fluorene	67	267	397	300	251	360	153	193	89
Phenanthrene	190	687	957	757	610	853	320	457	193
Anthracene	120	677	1023	743	607	773	643	550	457
Carbazole	41	201	303	197	154	237	193	153	100
Fluoranthene	80	313	390	577	403	527	403	380	337
<b>SUB-TOTAL</b>	<b>681</b>	<b>2642</b>	<b>3462</b>	<b>3016</b>	<b>2301</b>	<b>3405</b>	<b>1851</b>	<b>2028</b>	<b>1287</b>
<b>CARCINOGENIC</b>									
Pyrene	54	197	223	373	273	337	297	253	227
Benzo(a)anthracene	14	55	89	75	73	74	66	54	56
Chrysene	17	84	91	90	122	94	90	73	78
Benzo(b)fluoranthene	6 J	22	36	36	39	37	35	37	45
Benzo(k)fluoranthene	6 J	24	37	36	37	45	38	37	44
Benzo(a)pyrene	5 J	23	35	31	33	38	28	35	42
<b>SUB-TOTAL</b>	<b>102</b>	<b>405</b>	<b>512</b>	<b>642</b>	<b>577</b>	<b>625</b>	<b>554</b>	<b>489</b>	<b>492</b>
<b>TOTAL</b>	<b>783</b>	<b>3047</b>	<b>3973</b>	<b>3657</b>	<b>2878</b>	<b>4030</b>	<b>2405</b>	<b>2517</b>	<b>1779</b>
<b>Pentachlorophenol</b>	<b>8</b>	<b>17</b>	<b>43</b>	<b>63</b>	<b>44</b>	<b>42</b>	<b>33</b>	<b>35</b>	<b>23</b>

AR302429

DRAFT

TABLE 6  
SOUTHERN MARYLAND WOODTREATING SITE  
Results based on dry weight of soil (parts per million)  
LAND TREATMENT CELL 2  
May, 1993

COMPOUND NAME	DAY 0 LTC2	DAY 10 LTC2	DAY 20 LTC2	DAY 40 LTC2	DAY 80 LTC2	DAY 120 LTC2	DAY 180 LTC2	DAY 230 LTC2	DAY 250 LTC2
<b>NON-CARCINOGENIC</b>									
Naphthalene	200	46	13	54	14	40	10	170	165
Acenaphthene	140	250	253	137	183	117	126	164	154
Fluorene	130	247	233	135	169	124	119	161	159
Phenanthrene	340	567	487	347	430	249	253	38	387
Anthracene	240	510	573	497	760	367	570	423	563
Carbazole	78	104	157	99	216	182	154	137	164
Fluoranthene	160	333	380	360	447	296	410	287	347
SUB-TOTAL	1288	2057	2096	1628	2219	1375	1642	1380	1939
<b>CARCINOGENIC</b>									
Pyrene	100	160	267	263	307	247	293	210	233
Benzo(a)anthracene	25	64	87	63	77	57	71	49	58
Chrysene	31	74	89	79	140	75	97	58	79
Benzo(b)fluoranthene	11	26	36	36	39	32	37	33	43
Benzo(k)fluoranthene	12	27	36	36	37	40	40	33	42
Benzo(a)pyrene	10	25	34	30	34	30	31	32	39
SUB-TOTAL	189	376	548	508	633	481	569	415	494

<b>TOTAL</b>	1477	2432	2644	2136	2852	1856	2211	1795	2433
--------------	------	------	------	------	------	------	------	------	------

Pentachlorophenol	18	30	80	50	55	34	39	24	17
-------------------	----	----	----	----	----	----	----	----	----

AR302430

DRAFT

TABLE 7  
SOUTHERN MARYLAND WOODTREATING SITE  
Results based on dry weight of soil (parts per million)  
LAND TREATMENT CELL 3  
MAY, 1993

COMPOUND NAME	DAY 0 LTC3	DAY 10 LTC3	DAY 20 LTC3	DAY 40 LTC3	DAY 80 LTC3	DAY 120 LTC3	DAY 180 LTC3	DAY 230 LTC3	DAY 250 LTC3
<b>NON-CARCINOGENIC</b>									
Naphthalene	130	70	13	115	11	52	11	9	7
Acenaphthene	66	317	293	333	190	210	66	75	115
Fluorene	79	287	257	310	157	253	112	98	108
Phenanthrene	210	800	489	790	343	580	250	176	213
Anthracene	280	727	531	524	683	910	477	522	657
Carbazole	110	187	101	115	183	287	152	152	124
Fluoranthene	74	343	483	460	417	497	357	345	507
<b>SUB-TOTAL</b>	<b>948</b>	<b>2730</b>	<b>2167</b>	<b>2648</b>	<b>1984</b>	<b>2789</b>	<b>1425</b>	<b>1377</b>	<b>1731</b>
<b>CARCINOGENIC</b>									
Pyrene	48	223	257	187	293	320	260	250	383
Benzo(a)anthracene	12	63	90	74	72	73	55	45	75
Chrysene	15	79	89	86	126	98	92	63	103
Benzo(b)fluoranthene	5 J	27	37	35	35	33	28	33	52
Benzo(k)fluoranthene	6 J	30	37	36	33	44	33	34	52
Benzo(a)pyrene	4	26	34	30	31	33	23	32	47
<b>SUB-TOTAL</b>	<b>90</b>	<b>449</b>	<b>545</b>	<b>448</b>	<b>590</b>	<b>601</b>	<b>491</b>	<b>457</b>	<b>712</b>

<b>TOTAL</b>	<b>1038</b>	<b>3179</b>	<b>2712</b>	<b>3096</b>	<b>2575</b>	<b>3390</b>	<b>1916</b>	<b>1834</b>	<b>2443</b>
--------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

<b>Pentachlorophenol</b>	<b>8</b>	<b>42</b>	<b>78</b>	<b>58</b>	<b>64</b>	<b>50</b>	<b>9</b>	<b>34</b>	<b>69</b>
--------------------------	----------	-----------	-----------	-----------	-----------	-----------	----------	-----------	-----------

AR302431

DRAFT

TABLE 8  
SOUTHERN MARYLAND WOODTREATING SITE  
Results based on dry weight of soil (parts per million)  
LAND TREATMENT CELL 4  
May, 1993

COMPOUND NAME	DAY 0 LTC4	DAY 10 LTC4	DAY 20 LTC4	DAY 40 LTC4	DAY 80 LTC4	DAY 120 LTC4	DAY 180 LTC4	DAY 230 LTC4	DAY 250 LTC4
<b>NON-CARCINOGENIC</b>									
Naphthalene	830	10	11	11	11	10	7	33	34
Acenaphthene	480	273	307	203	180	108	58	94	187
Fluorene	470	227	260	193	159	119	88	107	141
Phenanthrene	1300	570	261	423	340	240	177	227	370
Anthracene	960	593	284	640	567	497	400	407	463
Carbazole	180	123	120	190	159	140	127	121	121
Fluoranthene	520	353	347	450	393	363	270	307	340
<b>SUB-TOTAL</b>	4740	2150	1589	2111	1809	1477	1127	1296	1656
<b>CARCINOGENIC</b>									
Pyrene	340	233	263	307	293	237	200	210	233
Benzo(a)anthracene	93	68	93	73	69	57	44	44	56
Chrysene	110	82	93	91	102	74	70	61	73
Benzo(b)fluoranthene	41	29	41	39	35	30	22	26	38
Benzo(k)fluoranthene	45	32	41	40	34	35	26	28	40
Benzo(a)pyrene	39	28	36	33	30	27	20	26	36
<b>SUB-TOTAL</b>	667	473	567	583	564	460	382	395	476

<b>TOTAL</b>	5407	2623	2156	2694	2374	1937	1509	1691	2132
<b>Pentachlorophenol</b>	66	36	93	57	64	36	11	25	20

PR302432

**TABLE 9**  
**SOUTHERN MARYLAND WOODTREATING SITE**  
 Results based on dry weight of soil (parts per million)  
**LAND TREATMENT CELL 5**  
 May, 1993

COMPOUND NAME	DAY 0 LTC5	DAY 10 LTC5	DAY 20 LTC5	DAY 40 LTC5	DAY 80 LTC5	DAY 120 LTC5	DAY 180 LTC5	DAY 230 LTC5	DAY 250 LTC5
<b>NON-CARCINOGENIC</b>									
Naphthalene	160	160	533	160	218	126	142	237	108
Acenaphthene	120	257	340	220	243	170	181	350	217
Fluorene	120	233	343	213	273	183	197	340	207
Phenanthrene	310	643	920	487	490	413	510	800	533
Anthracene	260	460	750	380	527	450	500	757	637
Carbazole	79	142	177	121	173	147	140	237	173
Fluoranthene	150	260	197	230	283	277	203	517	474
<b>SUB-TOTAL</b>	<b>1199</b>	<b>2155</b>	<b>3260</b>	<b>1811</b>	<b>2208</b>	<b>1766</b>	<b>1873</b>	<b>3238</b>	<b>2349</b>
<b>CARCINOGENIC</b>									
Pyrene	98	197	167	177	210	187	149	360	270
Benzo(a)anthracene	24	221	77	46	64	45	43	69	68
Chrysene	28	276	78	59	77	58	62	88	88
Benzo(b)fluoranthene	10	90	33	22	32	22	19	42	42
Benzo(k)fluoranthene	10	88	33	23	31	25	22	43	42
Benzo(a)pyrene	9	76	29	19	25	21	17	41	38
<b>SUB-TOTAL</b>	<b>178</b>	<b>948</b>	<b>417</b>	<b>345</b>	<b>440</b>	<b>358</b>	<b>312</b>	<b>643</b>	<b>548</b>

<b>TOTAL</b>	<b>1377</b>	<b>3103</b>	<b>3677</b>	<b>2156</b>	<b>2647</b>	<b>2124</b>	<b>2185</b>	<b>3881</b>	<b>2897</b>
--------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

Pentachlorophenol	17	59	52	25	44	20	18	38	12
-------------------	----	----	----	----	----	----	----	----	----

AR302433

DRAFT

TABLE 10  
SOUTHERN MARYLAND WOODTREATING SITE  
Results based on dry weight of soil (parts per million)  
LAND TREATMENT CELL 6  
May, 1993

COMPOUND NAME	DAY 0 LTC6	DAY 10 LTC6	DAY 20 LTC6	DAY 40 LTC6	DAY 80 LTC6	DAY 120 LTC6	DAY 180 LTC6	DAY 230 LTC6	DAY 250 LTC6
<b>NON-CARCINOGENIC</b>									
Naphthalene	180	27	287	89	81	107	5	88	110
Acenaphthene	120	263	353	197	213	187	47	160	210
Fluorene	120	230	340	193	203	220	47	170	197
Phenanthrene	320	577	927	420	264	470	101	390	557
Anthracene	250	547	833	460	290	580	145	477	600
Carbazole	83	116	133	163	107	200	42	150	153
Fluoranthene	140	360	203	297	253	373	99	313	393
<b>SUB-TOTAL</b>	1213	2119	3076	1819	1413	2137	486	1748	2220
<b>CARCINOGENIC</b>									
Pyrene	92	220	167	227	187	250	66	220	233
Benzo(a)anthracene	22	64	93	48	62	57	15	45	60
Chrysene	28	72	95	60	77	74	23	61	75
Benzo(b)fluoranthene	10	27	40	23	34	30	8	27	35
Benzo(k)fluoranthene	10	28	41	24	35	35	8	29	36
Benzo(a)pyrene	9	23	38	21	27	29	7	27	33
<b>SUB-TOTAL</b>	171	435	474	403	422	475	127	409	472

<b>TOTAL</b>	1384	2554	3550	2222	1835	2612	613	2157	2692
--------------	------	------	------	------	------	------	-----	------	------

<b>Pentachlorophenol</b>	13	44	56	26	45	27	5	20	8
--------------------------	----	----	----	----	----	----	---	----	---

AR302434

**Table 11**  
**Soil Boring Results - Surface Samples**  
**Southern Maryland Woodtreating Site**  
**Hollywood, MD**  
**April, 1993**

**DRAFT**

Sample Number	A19527	A19535	A19543	A19925	A19932	A19944	A19952
Sample Location	B-1(0-2')	B-2(0-2')	B-3(0-2')	B-4(0-2')	B-5(0-2')	B-6(0-2')	B-7(0-2')
Compound							
Naphthalene	84.3	nd	2.7 J	16.3	nd	nd	3.8 J
Acenaphthene	140.0	nd	59.5	81.6	40.7	11.4	3.5 J
Fluorene	100.0	nd	51.9	70.0	4.6 J	nd	2.8 J
PENTACHLOROPHENOL	20.1	2.7 J	14.9	180.0	58.5	nd	nd
Phenathrene	250.0	nd	100.0	220.0	6.1	nd	6.9
Anthracene	170.0	4.1 J	190.0	220.0	230.0	19.3	9.6
Carbazole	48.0	nd	56.4	60.0	7.1	nd	nd
Fluoranthene	190.0	2.8 J	140.0	270.0	430.0	24.3	7.5
Pyrene	130.0	3.7 J	94.8	240.0	390.0	17.7	5.1 J
Benzo (a) anthracene	32.5	1.3 J	19.5	39.1	72.2	3.0 J	nd
Chrysene	33.8	4.0 J	25.9	57.5	110.0	4.5 J	nd
Benzo (b) fluoranthene	16.3	4.2 J	10.6	29.1	52.6	2.9 J	nd
Benzo (k) fluoranthene	17.1	6.6	9.8	28.6	48.2	nd	nd
Benzo (a) pyrene	15.1	7.8	7.8	25.3	43.5	3.0 J	nd

nd = The compound was analyzed but not detected at or below the detection limit

J = Data indicates the presence of a compound that meets the identification criteria. The result is less than the lowest linear detection limit of 0.5 ug/ml but greater than zero; the concentrations are given as an approximate value.

HICP = High Contamination Stockpile located within sheetpile wall.  
 Results in milligrams/kilograms.

**DRAFT**

**Table 12**  
**Soil Boring Results - Depth Samples**  
**Southern Maryland Woodtreating Site**  
**Hollywood, Md**  
**April, 1993**

Sample Number	A19528	A19544	A19941	A19942	A19943	A19923
Sample Location	B-1(5-7')	B-3(5-7')	HICP(18-24')	HICP(36')	HICP(45')	HICP(0-6')
Compound						
Naphthalene	nd	nd	300.0	230.0	390.0	220.0
Acenaphthene	nd	1.4 J	170.0	120.0	200.0	170.0
Fluorene	nd	nd	150.0	97.1	170.0	140.0
PENTACHLOROPHENOL	nd	nd	nd	nd	nd	nd
Phenathrene	nd	1.4 J	420.0	290.0	490.0	380.0
Anthracene	nd	2.1 J	120.0	53.5	130.0	92.9
Carbazole	nd	nd	46.9	21.6	53.9	38.5
Fluoranthene	nd	1.9 J	240.0	150.0	250.0	230.0
Pyrene	nd	1.4 J	160.0	100.0	170.0	160.0
Benzo (a) anthracene	40.5	nd	34.5	22.4	35.8	34.4
Chrysene	36.2	nd	39.2	25.8	40.2	37.9
Benzo (b) fluoranthene	nd	nd	13.6	8.8	14.0	14.0
Benzo (k) fluoranthene	nd	nd	14.8	8.5	14.0	12.8
Benzo (a) pyrene	nd	nd	12.4	7.7	13.3	12.3

nd = The compound was analyzed but not detected at or below the detection limit

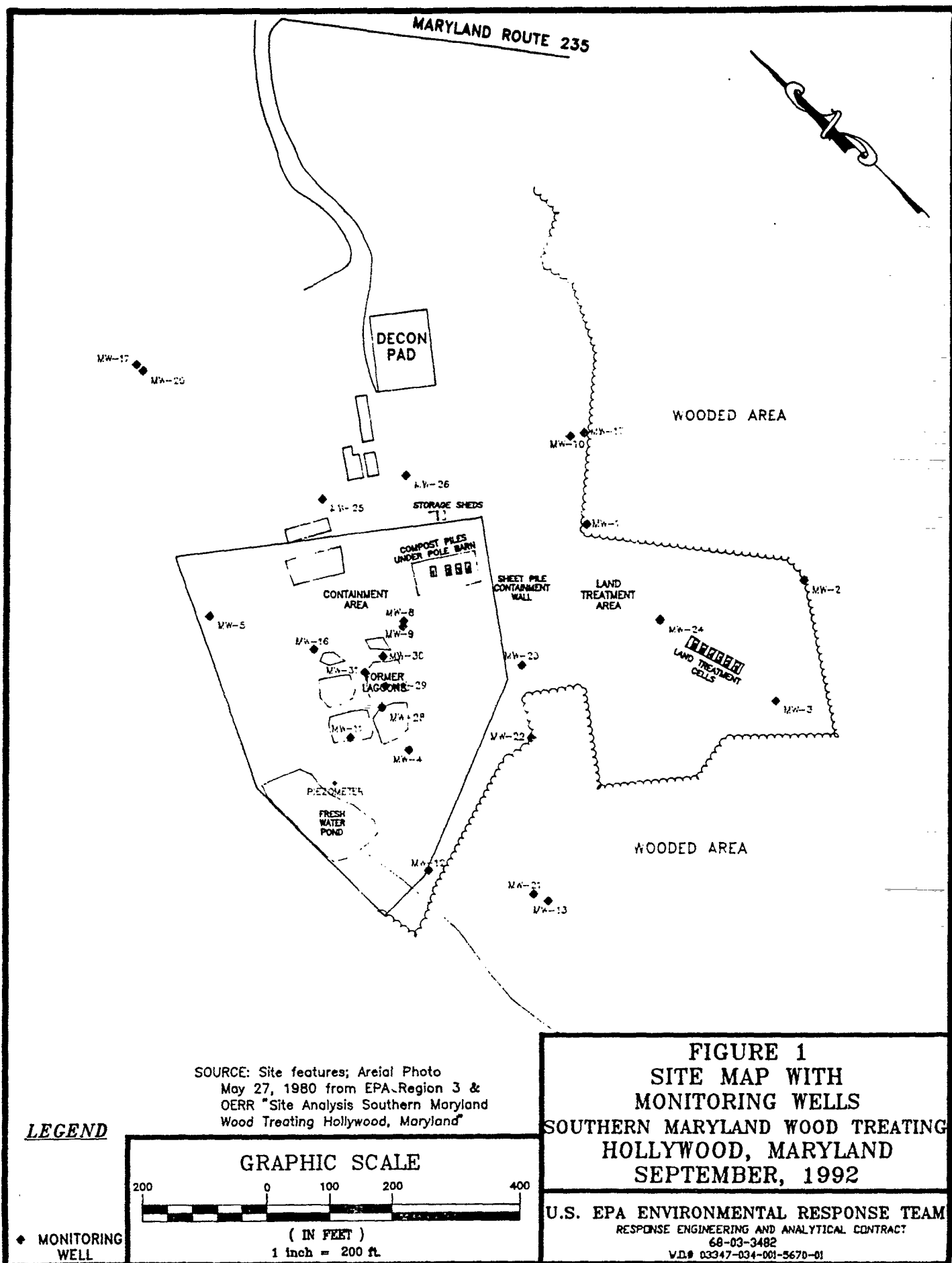
J = Data indicates the presence of a compound that meets the identification criteria. The result is less than the lowest linear detection limit of 0.5 ug/ml but greater than zero; the concentrations are given as an approximate value.

HICP = High Contamination Stockpile located within sheetpile wall.

Results in milligrams/kilograms

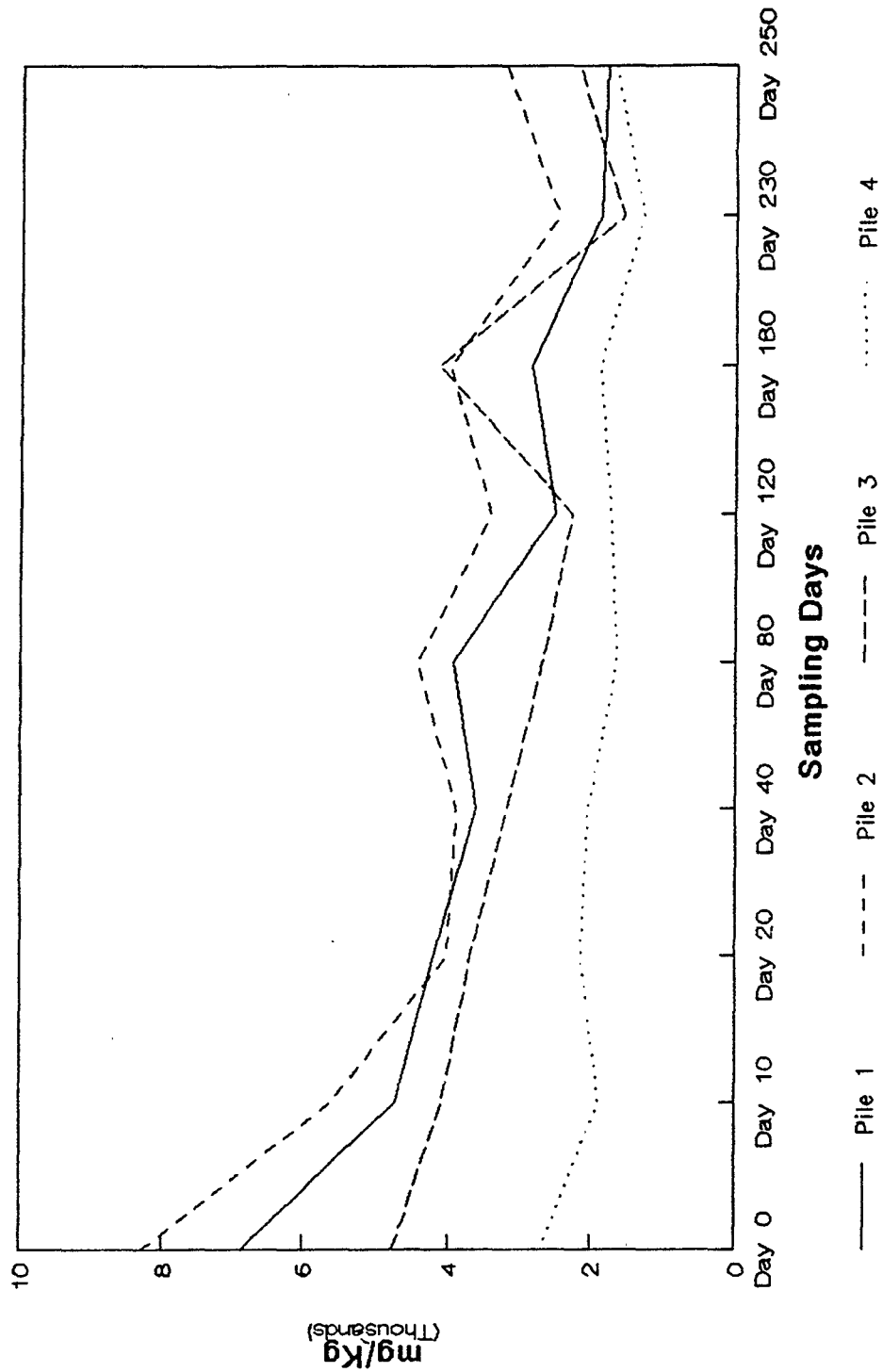
AR302436

SMWT.WK3



AR302437

# Non-Carcinogenic Results Compost Piles



US EPA ENVIRONMENTAL RESPONSE TEAM  
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

68-03-3482

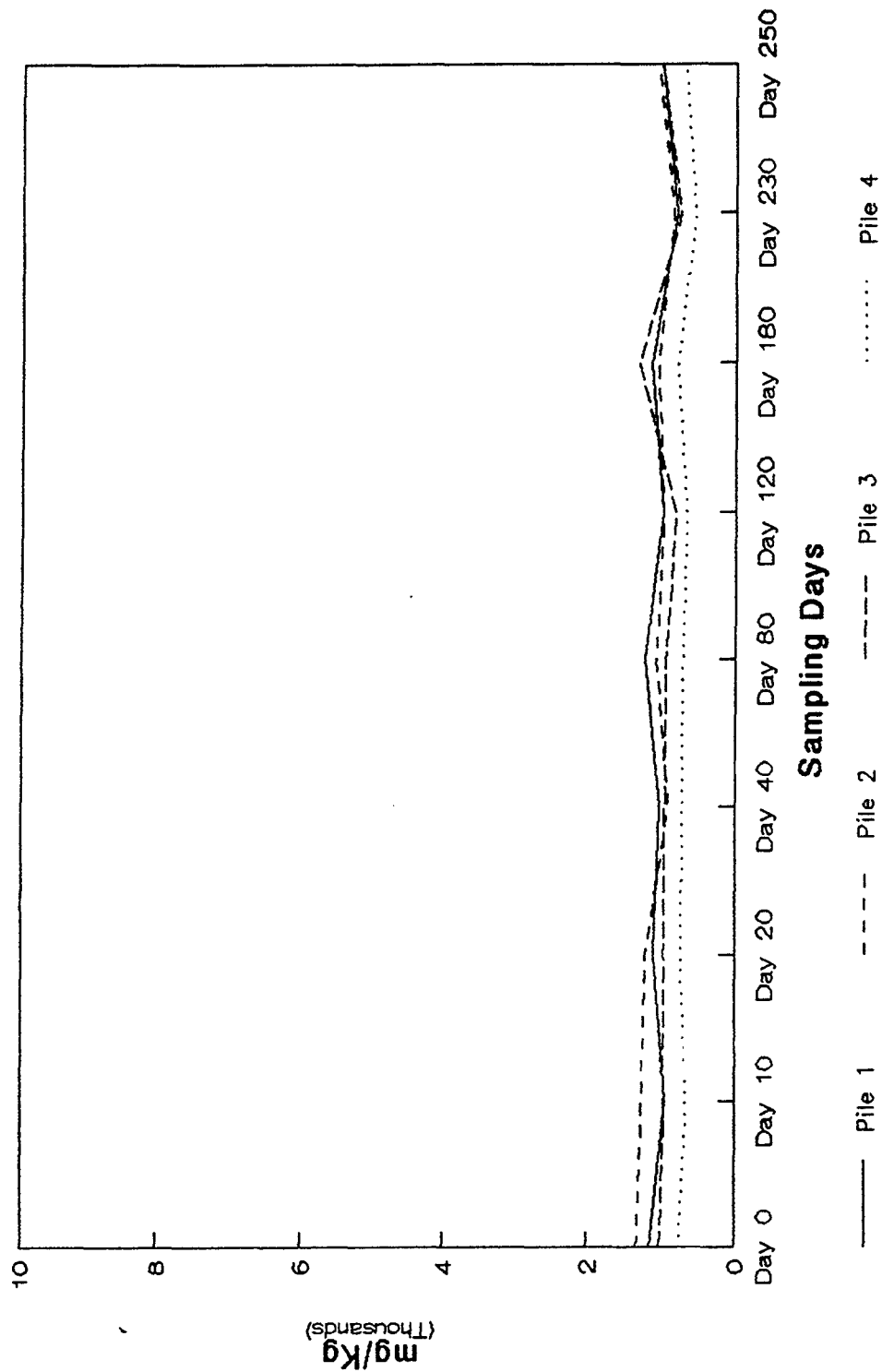
WO# 03347-034-001-5670-01

FIGURE 2

SOUTHERN MARYLAND  
HOLLYWOOD, MARYLAND  
MAY, 1993

AR302438

# **Carcinogenic Results Compost Piles**



US EPA ENVIRONMENTAL RESPONSE TEAM  
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

68-03-3482

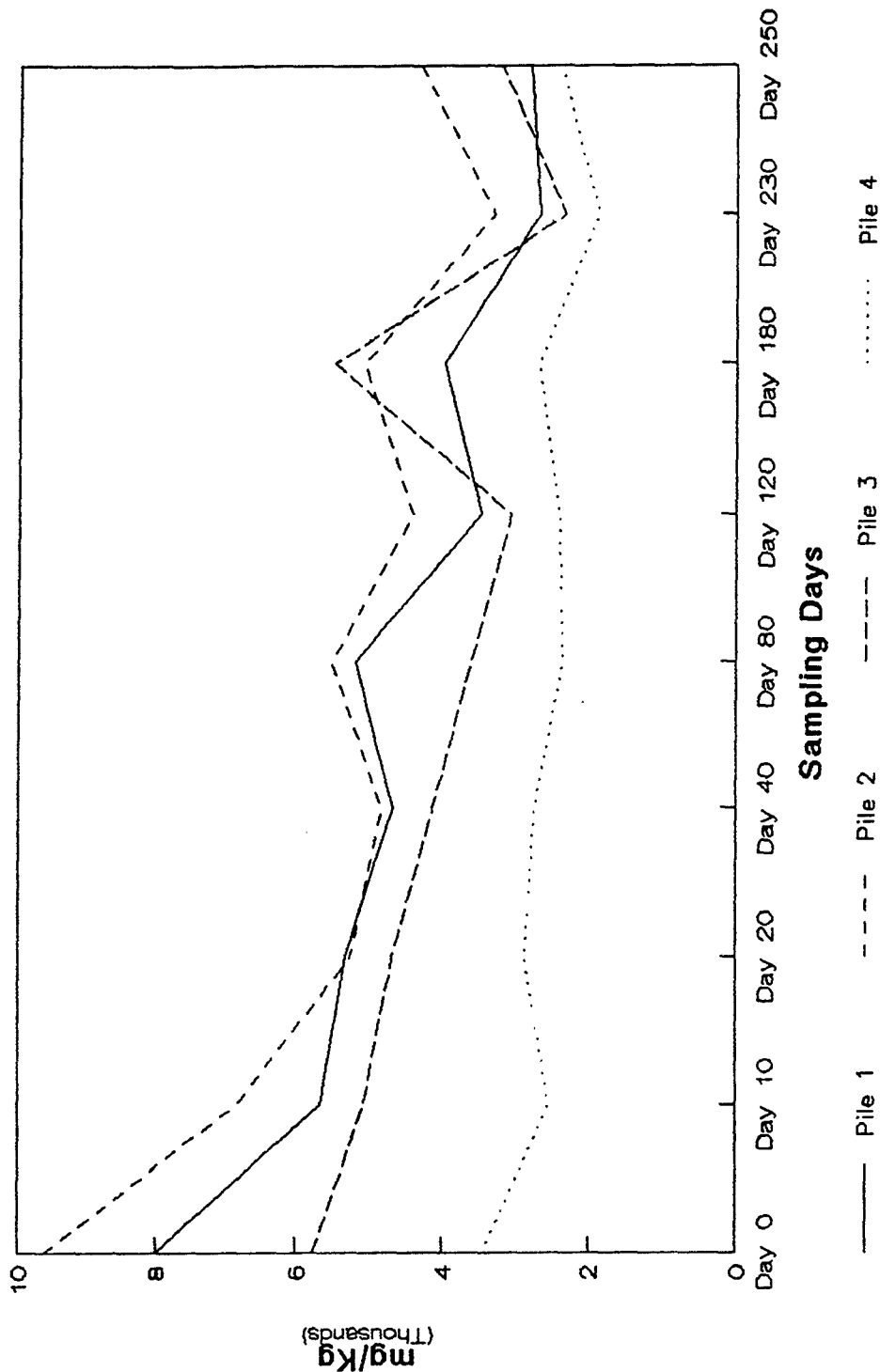
WO# 03347-034-001-5670-01

FIGURE 3

SOUTHERN MARYLAND  
HOLLYWOOD, MARYLAND  
May, 1993

AR302439

# **Total Creosote Results Compost Piles**

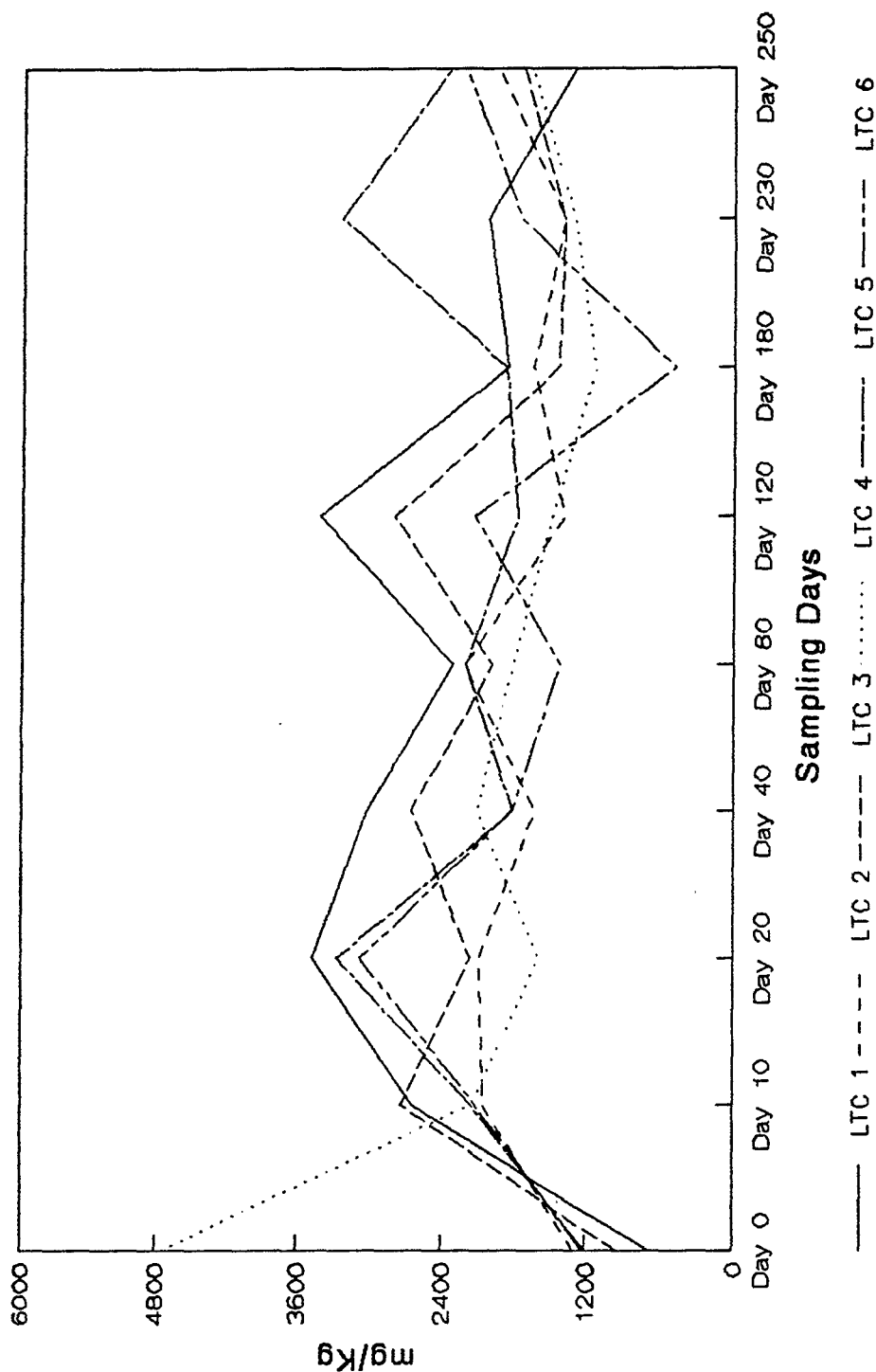


US EPA ENVIRONMENTAL RESPONSE TEAM  
 RESPONSE ENGINEERING AND ANALYTICAL CONTRACT  
 68-03-3482  
 WO# 03347-034-001-5670-01

FIGURE 4  
 SOUTHERN MARYLAND  
 HOLLYWOOD, MARYLAND  
 MAY, 1993

AR302440

# Non-Carcinogenic Results Land Treatment Cells



US EPA ENVIRONMENTAL RESPONSE TEAM  
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

68-03-3482

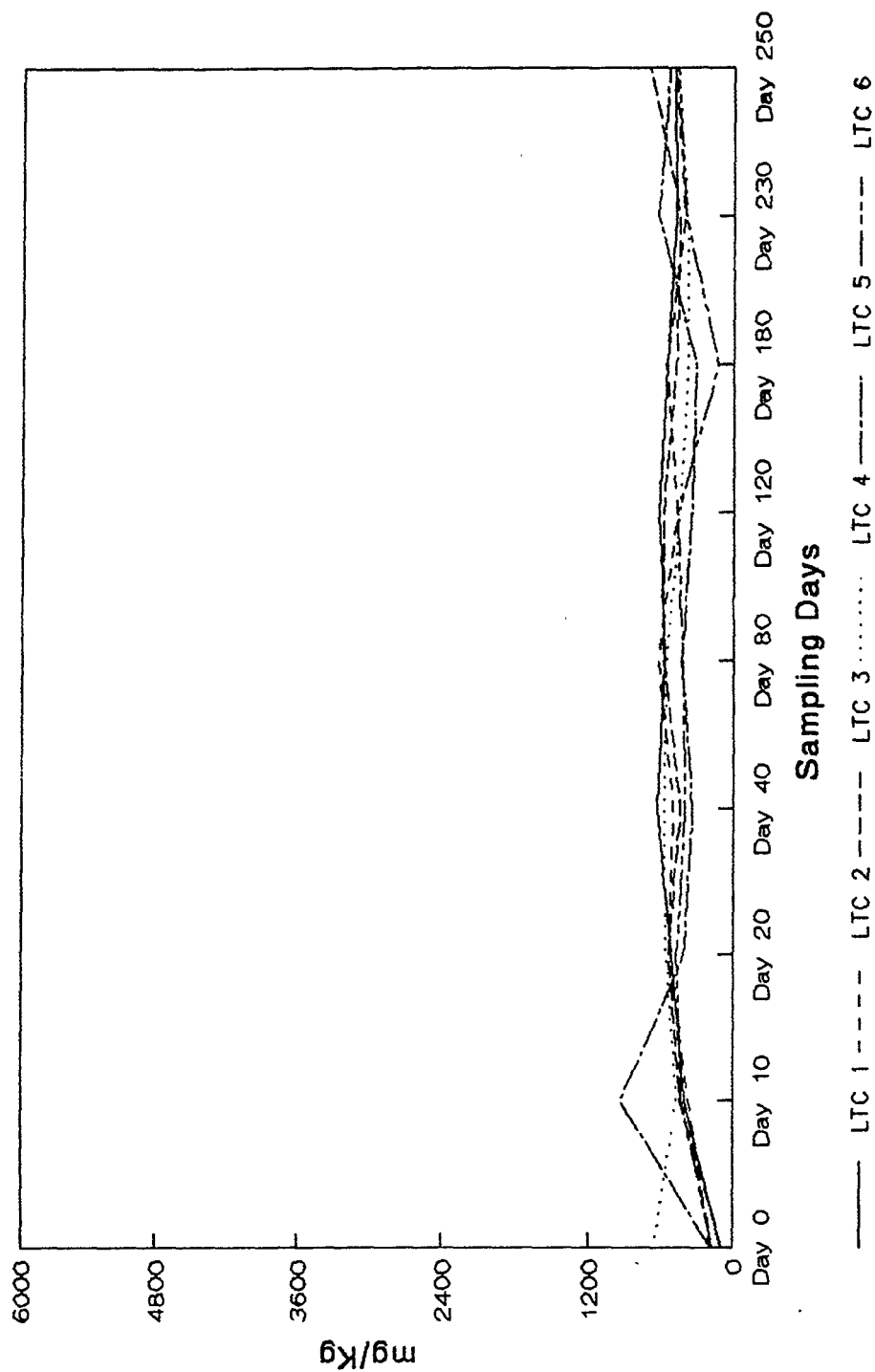
WO# 03347-034-001-5670-01

FIGURE 5

SOUTHERN MARYLAND  
HOLLYWOOD, MARYLAND  
MAY, 1993

AR302441

# **Carcinogenic Results Land Treatment Cells**



US EPA ENVIRONMENTAL RESPONSE TEAM  
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

68-03-3482

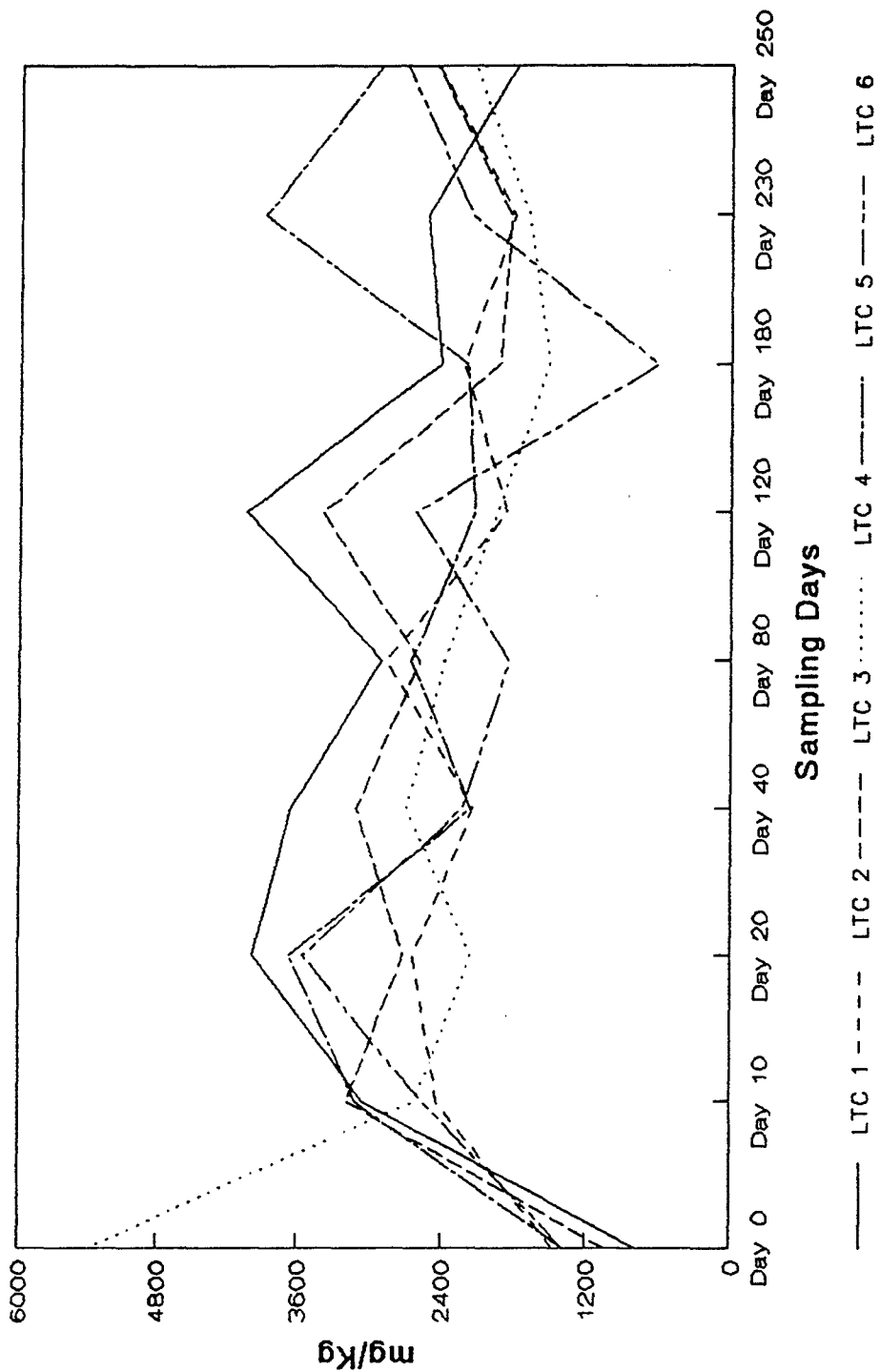
WO# 03347-034-001-5670-01

FIGURE 6

SOUTHERN MARYLAND  
HOLLYWOOD, MARYLAND  
MAY, 1993

AR302442

# **Total Creosote Results Land Treatment Cells**



US EPA ENVIRONMENTAL RESPONSE TEAM  
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

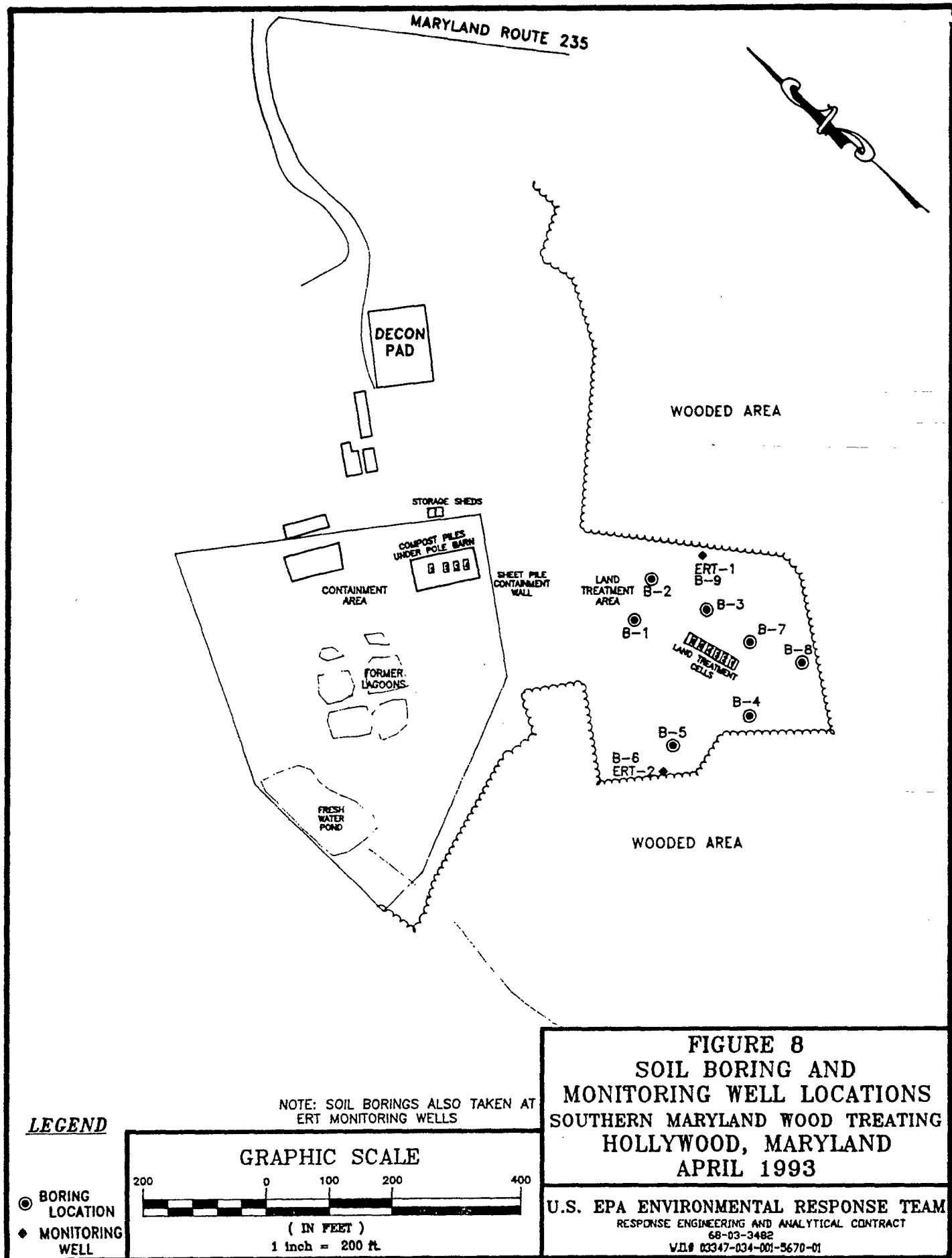
68-03-3482

WO# 03347-034-001-5670-01

FIGURE 7

SOUTHERN MARYLAND  
HOLLYWOOD, MARYLAND  
MAY, 1993

AR302443



AR302444

APPENDIX A  
SOIL BORING AND MONITORING WELL LOGS  
SOUTHERN MARYLAND WOODTREATING SITE  
HOLLYWOOD, MD  
JUNE, 1993

m\CARUSO\5670-SR

AR302445

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-01  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 147.000 estimated

TOTAL DEPTH : 37.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC  
 DRILLING RIG : MOBILE DRILL B-57  
 DATE STARTED : 04/27/93  
 DATE COMPLETED : 04/26/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
146	1		80	Silty sand, SM	BROWN	NA	MST	1	HNU 0.0	Topsoil - organic matter present
				Poorly graded sand with silt, SP-SM	DARK GREY	NA	MST	10	OVA 0.0	
				Poorly graded sand, SP	TAN & LT. OR.BR	NA	MST	19	HNU 0.0	Iron stained
145	2								OVA 0.0	
144	3								HNU 0.0	
143	4								OVA 0.0	
142	5		75	Poorly graded sand with silt, SP-SM	ORANGE	NA	MST	6	OVA 0.0	Iron stained
141	6							12	HNU 0.0	
140	7							13		
139	8									
138	9									
137	10		80	Poorly graded sand with silt, SP-SM	ORANGE & GREY	NA	MST	5	OVA 0.0	varved clay - grey clay
				Silty sand, SM	GREY, ORANGE, RED	NA	MST	11	HNU 0.0	plastic, moist, organic
136	11			Silty sand, SM	GREY & ORANGE	NA	MST	20	OVA 0.0	orange silty sand
								21	HNU 0.0	grey - clay
135	12								OVA 0.0	orange - silty fine sand
									HNU 0.0	red - silty fine sand
134	13									
133	14									
132	15		55	Poorly graded sand, SP	WHITE & ORANGE	NA	MST	10		alternating orange and white
131	16							10		
130	17							8		
129	18									
128	19									
127	20		75	Silty sand, SM	TAN & ORANGE	NA	MST	2		slough on top of split spoon, water @ 23' on auger
								4		
								4		
								4		

06/16/93

Page: 1 of 2

AR302446

# Borehole Log

ROY F. WESTON, Inc.

CLIENT	: U.S. EPA	TOTAL DEPTH	: 37.00
SITE NAME	: SMWT-5670	LOGGER	: CHARLES MCCUSKER, RFW/REAC
WELL ID	: B-01	DRILLING COMPANY	: ATEC ASSOCIATES, INC
NORTHING	: 0.0000 estimated	DRILLING RIG	: MOBILE DRILL B-57
EASTING	: 0.0000 estimated	DATE STARTED	: 04/27/93
ELEVATION	: 147.000 estimated	DATE COMPLETED	: 04/26/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
126	21			Silty sand, SM	TAN & ORANGE	NA	MST			slough on top of split spoon, water @ 23' on auger
125	22									
124	23									
123	24									
122	25		100	Poorly graded sand, SP	TAN	NA	WET	6		
121	26							14-25		
120	27									
119	28									
118	29									
117	30		100	Fat clay, CH		NA	WET	5		Running sands - using split spoon to keep sand from running in. First uniform clay layer
116	31							8		
115	32									
114	33									
113	34									
112	35		100	Fat clay, CH	GREY	SFT	MST	2		Bedding thickness "full spoon"
111	36									
110	37									
109	38									
108	39									
107	40									

06/16/93

Page: 2 of 2  
AR302447

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-02  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 146.000 estimated

TOTAL DEPTH : 37.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC.  
 DRILLING RIG : MOBILE DRILL B-57  
 DATE STARTED : 04/27/93  
 DATE COMPLETED : 04/27/93

ELEVATION	DEPTH	MATERIAL	RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
145	1		40	Silty sand, SM	LT. BRN AND BRN	NA	MST	3	OVA 0.0 HNU 0.0	topsoil - rootlets throughout
144	2									
143	3									
142	4									
141	5		90	Silty sand, SM	BROWN	NA	MST	8	OVA 0.0 HNU 0.0	
140	6			Silty sand, SM	ORANGE	NA	MST	11	OVA 0.0 HNU 0.0	
139	7									
138	8									
137	9									
136	10		80	Silty sand, SM	ORANGE	NA	MST	11	OVA 0.0 HNU 0.0	
135	11			Silty sand, SM	ORANGE	NA	MST	13	OVA 0.0 HNU 0.0	
134	12							15	OVA 0.0 HNU 0.0	secondary lithology present - see book for note
133	13									
132	14									
131	15		80	Poorly graded sand, SP	TAN & ORANGE	NA	MST	6	OVA 0.0 HNU 0.0	
130	16							4		
129	17									
128	18									
127	19									
126	20		100	Silty sand, SM	ORANGE & LT GRY	NA	WET	3	OVA 0.0 HNU 0.0	

06/16/93

Page: 1 of 2

AR302448

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-02  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 146.000 estimated

TOTAL DEPTH : 37.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC.  
 DRILLING RIG : MOBILE DRILL B-57  
 DATE STARTED : 04/27/93  
 DATE COMPLETED : 04/27/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
125	21			Silty sand, SM	ORANGE & LT GRY	NA	WET		OVA 0.0 HNU 0.0	
124	22									
123	23									
122	24									
121	25		100	Silty sand, SM	ORANGE & LT. GR	NA	WET	7		
120	26			Poorly graded sand with silt, SP-SM	DARK ORANGE	NA	WET	16 28 48		Heavy iron staining
119	27									
118	28									
117	29									
116	30		100	Poorly graded sand with silt, SP-SM	DARK ORANGE	NA	WET	3	OVA 0.0 HNU 0.0	
115	31			Fat clay, CH	ORANGE & LT GRY	NA	WET	4 4 4	OVA 0.0 HNU 0.0	Orange & Lt. Grey varved silty clay, moist, plastic, soft
114	32									
113	33									
112	34									
111	35		100	Fat clay, CH	ORANGE & LT. GR	NA	WET		OVA 0.0 HNU 0.0	sample from grey clay only
110	36			Fat clay, CH	GREY	NA	WET		OVA 0.0 HNU 0.0	
109	37									
108	38									
107	39									
106	40									

06/16/93

Page: 2 of 2

AR302449

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-03  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 144.000 estimated

TOTAL DEPTH : 37.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC.  
 DRILLING RIG : MOBILE DRILL B-57  
 DATE STARTED : 04/27/93  
 DATE COMPLETED : 04/27/93

ELEVATION	DEPTH	MATERIAL	RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
143	1		75	Silty sand, SM	LT. BROWN	NA	MST	3	HNU 0.0	rootlets present throughout
				Elastic silt with sand, MH	LT.GREY & BRWN	NA	MST	28	HNU 0.0	
				Silty sand, SM	DARK BROWN	NA	MST			
142	2									
141	3									
140	4									
139	5		75	Poorly graded sand with silt, SP-SM	WHITE	NA	DRY	20	HNU 0.0	
138	6			Poorly graded sand with silt, SP-SM	WHITE	NA	DRY	11	HNU 0.0	
				Sandy silt, ML	ORANGE & TAN	NA	MST	8		
137	7									
136	8									
135	9									
134	10		62	Silty sand, SM	WHITE/LT.GRAY	NA	MST	7	HNU 0.0	
				Silty sand, SM	ORANGE	NA	MST	8	HNU 0.0	
133	11							5		
132	12									
131	13									
130	14									
129	15		100	Silty sand, SM	ORANGE & LT.GRY	NA	MST	4	HNU 0.0	
128	16			Poorly graded sand with silt, SP-SM	ORANGE	NA	MST	5	HNU 0.0	
127	17							5		
126	18									
125	19									
124	20		100	Poorly graded sand, SP	ORANGE	NA	WET	6		iron stained
								11		
								10		
								11		

06/16/93

Page: 1 of 2

AR302450

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA	TOTAL DEPTH : 37.00
SITE NAME : SMWT-5670	LOGGER : CHARLES MCCUSKER, RFW/REAC
WELL ID : B-03	DRILLING COMPANY : ATEC ASSOCIATES, INC.
NORTHING : 0.0000 estimated	DRILLING RIG : MOBILE DRILL B-57
EASTING : 0.0000 estimated	DATE STARTED : 04/27/93
ELEVATION : 144.000 estimated	DATE COMPLETED : 04/27/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
123 - 21				Poorly graded sand, SP	ORANGE	NA	WET			iron stained
122 - 22										
121 - 23										
120 - 24										
119 - 25			100	Sandy silt, ML	ORANGE & TAN	NA	MST	20	HNU 0.0	
118 - 26								40		
117 - 27								40		
116 - 28										
115 - 29										
114 - 30			100	Poorly graded sand with silt, SP-SM	ORANGE	NA	MST	20		
113 - 31				Fat clay, CH	ORANGE & LT.GRY	NA	WET	20		varved orange and light grey silty clay
112 - 32										
111 - 33										
110 - 34										
109 - 35			100	Fat clay, CH	GREY	NA	MST	20		SOME SLOUGH
108 - 36										
107 - 37										
106 - 38										
105 - 39										
104 - 40										

06/16/93

Page 2 of 2  
AR302450F 2

# Borehole Log

ROY F. WESTON, Inc.

CLIENT	: U.S. EPA	TOTAL DEPTH	: 32.00
SITE NAME	: SMWT-5670	LOGGER	: CHARLES MCCUSKER, RFW/REAC
WELL ID	: B-04	DRILLING COMPANY	: ATEC ASSOCIATES, INC.
NORTHING	: 0.0000 estimated	DRILLING RIG	: MOBILE DRILL B-57
EASTING	: 0.0000 estimated	DATE STARTED	: 04/28/93
ELEVATION	: 143.000 estimated	DATE COMPLETED	: 04/28/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
142	1		65	Silty sand, SM	DARK BROWN	NA	MST	7	OVA 0.0 HNU 0.0	Topsoil, organic matter throughout
141	2			Poorly graded sand with silt, SP-SM	TAN	NA	MST	13	OVA 0.0 HNU 0.0	
140	3									
139	4									
138	5		75	Silt with sand, ML	TAN, GREY, RED	NA	MST	6	OVA 0.0 HNU 0.0	
137	6							10		
136	7							11		
135	8									
134	9									
133	10		85	Poorly graded sand, SP	ORANGE & GREY	NA	MST	4	OVA 0.0 HNU 0.0	varved grey-silty clay and orange silty fine sand
132	11							4		
131	12							6		
130	13									
129	14									
128	15		90	Poorly graded sand, SP	ORANGE & GREY	NA	MST	4	OVA 0.0 HNU 0.0	
127	16							4		
126	17									
125	18									
124	19									
123	20		85	Poorly graded sand with silt, SP-SM	ORANGE	NA	WET	4	OVA 0.0 HNU 0.0	
								6		
								9		
								14		

06/16/93

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-04  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 143.000 estimated

TOTAL DEPTH : 32.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC.  
 DRILLING RIG : MOBILE DRILL B-57  
 DATE STARTED : 04/28/93  
 DATE COMPLETED : 04/28/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
122 - 21				Poorly graded sand with silt, SP-SM	ORANGE	NA	WET		OVA 0.0 HNU 0.0	
121 - 22										
120 - 23										
119 - 24										
118 - 25			100	Poorly graded sand with silt, SP-SM	ORANGE	NA	WET	3	OVA 0.0 HNU 0.0	
117 - 26				Fat clay, CH	ORANGE & GREY	NA	MST	7	OVA 0.0 HNU 0.0	varved grey and orange silty clay
116 - 27										
115 - 28										
114 - 29										
113 - 30			100	Fat clay, CH	ORANGE & GREY	NA	MST	3	OVA 0.0 HNU 0.0	
112 - 31				Fat clay, CH	DARK GREY	NA	MST	3	OVA 0.0 HNU 0.0	
111 - 32										
110 - 33										
109 - 34										
108 - 35										
107 - 36										
106 - 37										
105 - 38										
104 - 39										
103 - 40										

06/16/93

Page: 2 of 2  
 AR302453

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-05  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 145.000 estimated

TOTAL DEPTH : 37.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC  
 DRILLING RIG : MOBILE DRILL B-57  
 DATE STARTED : 04/28/93  
 DATE COMPLETED : 04/28/93

ELEVATION	DEPTH	MATERIAL	RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
144	1		65	Sandy silt, ML	DARK BROWN	NA	MST	3	OVA 0.0	top soil rootlets throughout, loamy
				Well-graded sand, SW	BROWN	NA	MST	1	OVA 0.0	
				Silty sand, SM	LIGHT BROWN	NA	MST	5	OVA 0.0	
143	2									
142	3									
141	4									
140	5		100	Poorly graded sand, SP	TAN	NA	MST	14	OVA 0.0	
139	6			Silty sand, SM	ORANGE & TAN	NA	MST	10	OVA 0.0	
138	7									
137	8									
136	9									
135	10		80	Poorly graded sand with silt, SP-SM	ORANGE	NA	MST	10	OVA 0.0	
134	11							20		
133	12							14		
132	13									
131	14									
130	15		80	Silty sand, SM	TAN	NA	MST	4	OVA 0.0	varved orange (silty fine sand) and (t. grey (silty clay)
129	16			Silty sand, SM	ORANGE & LT.GRY	NA	MST	6	OVA 0.0	
128	17							6		
127	18									
126	19									
125	20		75	Well-graded sand, SW	WHITE	NA	WET	4	OVA 0.0	clay pockets - white silty clay, plastic

06/17/93

Page: 2  
 AR302454

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-05  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 145.000 estimated

TOTAL DEPTH : 37.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC  
 DRILLING RIG : MOBILE DRILL B-57  
 DATE STARTED : 04/28/93  
 DATE COMPLETED : 04/28/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
124	21			Well-graded sand, SW	WHITE	NA	WET		OVA 0.0	Clay pockets - white silty clay, plastic
123	22									
122	23									
121	24									
120	25		100	Silty sand, SM	ORANGE & LT.GRY	NA	WET	1	OVA 0.0	orange - sand lt. grey - silty clay
119	26									
118	27			Poorly graded sand with silt, SP-SM	ORANGE & LT.GRY	NA	WET		OVA 0.0	orange - sand lt. grey - silty clay
117	28									
116	29									
115	30		100	Poorly graded sand, SP	WHITE	NA	WET	3	OVA 0.0	
114	31									
113	32			Fat clay, CH	ORANGE & LT.GRY	NA	MST		OVA 0.0	varved silty clay
112	33									
111	34									
110	35		100	Fat clay, CH	DARK GREY	NA	MST	3	OVA 0.0	
109	36									
108	37									
107	38									
106	39									
105	40									

06/17/93

Page: 2 of 2

AR302455

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-06  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 145.000 estimated

TOTAL DEPTH : 37.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC  
 DRILLING RIG : MOBILE DRILL B-57  
 DATE STARTED : 04/29/93  
 DATE COMPLETED : 04/29/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
144 - 1			80	Silt with sand, ML	DARK BROWN	NA	MST	4	OVA 0.0	Topsoil
143 - 2				Elastic silt with sand, MH	ORANGE & BROWN	NA	DRY	6	OVA 0.0	
142 - 3										
141 - 4										
140 - 5			100	Elastic silt with sand, MH	ORANGE & BROWN	NA	DRY	5	OVA 0.0	15-17/downgrade to level
139 - 6								10		
138 - 7										
137 - 8										
136 - 9										
135 - 10			75	Poorly graded sand, SP	TAN AND ORANGE	NA	MST	4	OVA 0.0	slough (approximately 2")
134 - 11								11		in top of spoon
133 - 12								11		
132 - 13										
131 - 14										
130 - 15			80	Poorly graded sand, SP	DK REDDISH BROW	NA	MST	5	OVA 0.0	
129 - 16				Silty sand, SH	TAN & ORANGE	NA	MST	4	OVA 0.0	
128 - 17										
127 - 18										
126 - 19										
125 - 20			95	Silty sand, SH	ORANGE & LT GRY	NA	MST	4		orange - fine sand
								6		lt. grey clay
								6		varved clay

06/16/93

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-06  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 145.000 estimated

TOTAL DEPTH : 37.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC  
 DRILLING RIG : MOBILE DRILL B-57  
 DATE STARTED : 04/29/93  
 DATE COMPLETED : 04/29/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
124 - 21				Silty sand, SM	ORANGE & LT GRY	NA	MST			orange - fine sand lt. grey clay varved clay
123 - 22										
122 - 23										
121 - 24										
120 - 25			100	Silty sand, SM	ORANGE & LT GRY	NA	MST	11		slough (approximately 3") in top of spoon
119 - 26				Silty sand, SM			WET	14	OVA 0.0	
118 - 27								19		
117 - 28								28		
116 - 29										
115 - 30			100	Silty sand, SM	ORANGE	NA	WET	4		
114 - 31				Fat clay, CH	LT. ORANGE & GR	NA	WET	6		some varves with grey stringers
113 - 32								4		
112 - 33										
111 - 34										
110 - 35			100	Fat clay, CH	DARK GREY	NA	MST	2	OVA 0.0	BEDDING THICKNESS FULL SPOON. SOME SLOUGH
109 - 36								4		
108 - 37										
107 - 38										
106 - 39										
105 - 40										

06/16/93

AR302457

Page: 2 of 2

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT 5670  
 WELL ID : B-07  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 143.000 estimated

TOTAL DEPTH : 32.00  
 LOGGER : C. MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC.  
 DRILLING RIG : ATV  
 DATE STARTED : 04/30/93  
 DATE COMPLETED : 04/30/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			62	Silty sand, SM	DARK BROWN	NA	MST	3	OVA 0.0	topsoil- organic matter present throughout
				Sandy silt, ML	TAN & LIGHT GRE	NA	MST	6	OVA 0.0	
142	1									
141	2									
140	3									
139	4									
138	5		100	Sandy elastic silt, MH	TAN, LT. RD, LT GR	NA	MST	6	OVA 0.0	Some slough & topsoil
137	6							10		
136	7									
135	8									
134	9									
133	10		100	Poorly graded sand, SP	ORANGE	NA	MST	5		

06/17/93

Page: 1 of 4

AR302458

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT 5670  
 WELL ID : B-07  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 143.000 estimated

TOTAL DEPTH : 32.00  
 LOGGER : C. MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC.  
 DRILLING RIG : ATV  
 DATE STARTED : 04/30/93  
 DATE COMPLETED : 04/30/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Poorly graded sand, SP	ORANGE	NA	MST			
132	11			Poorly graded sand, SP	ORANGE & LT. GR	NA	MST			Mottled orange & light grey
131	12									
130	13									
129	14									
128	15		95	Poorly graded sand with silt, SP-SM	ORANGE	NA	MST	4	OVA 0.0	
				Poorly graded sand with silt, SP-SM	WHITE	NA	MST	4	OVA 0.0	
				Poorly graded sand with silt, SP-SM	FLESH & LT GREY	NA	MST		OVA 0.0	
127	16			fat clay, CH	LT. GREY	NA	MST		OVA 0.0	
126	17									
125	18									
124	19									
123	20		95	Silty sand, SM	RUST & ORANGE	NA	WET	7 10 17 13	OVA 0.0	

06/17/93

Page: 2 of 4

AR302459

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT 5670  
 WELL ID : B-07  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 143.000 estimated

TOTAL DEPTH : 32.00  
 LOGGER : C. MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC.  
 DRILLING RIG : ATV  
 DATE STARTED : 04/30/93  
 DATE COMPLETED : 04/30/93

ELEVATION	DEPTH	MATERIAL	RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
122	21			Silty sand, SM	RUST & ORANGE	NA	WET		OVA 0.0	
121	22			Well graded sand with silt, SW-SM	WHITE & TAN	NA	WET		OVA 0.0	
120	23									
119	24									
118	25		100	Poorly graded sand, SP	ORANGE	NA	WET	2	OVA 10.0	
117	26			Fat clay, CH	ORANGE & LT. GR	NA	MST		OVA 10.0	Orange and light grey varved silty clay
116	27									
115	28									
114	29									
113	30		100	Fat clay, CH	DARK GREY	NA	MST	1	OVA 0.0	

06/17/93

AR302460

Page: 3 of 4

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT 5670  
 WELL ID : B-07  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 143.000 estimated

TOTAL DEPTH : 32.00  
 LOGGER : C. MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC.  
 DRILLING RIG : ATV  
 DATE STARTED : 04/30/93  
 DATE COMPLETED : 04/30/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
112	31			Fat clay, CH	DARK GREY	NA	MST		OVA 0.0	
111	32									
110	33									
109	34									
108	35									
107	36									
106	37									
105	38									
104	39									
103	40									

06/17/93

Page: 4 of 4

AR302461

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-08  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 142.000 estimated

TOTAL DEPTH : 27.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC  
 DRILLING RIG : ATV  
 DATE STARTED : 04/30/93  
 DATE COMPLETED : 04/30/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
141	1		80	Sandy silt, ML	DARK BROWN	NA	MST	4	OVA 0.0	Topsoil - organic matter present
				Poorly graded sand, SP	LT. BROWN	NA	MST	4	OVA 0.0	
140	2			Poorly graded sand, SP	TAN	NA	MST	4	OVA 0.0	
139	3									
138	4									
137	5		100	Clayey sand, SC	ORANGE & LT. GRY	NA	MST	3	OVA 0.0	
136	6									
135	7									
134	8									
133	9									
132	10		100	Silty sand, SM	ORANGE & LT GRY	NA	MST	5		
131	11									
130	12									
129	13									
128	14									
127	15		70	Poorly graded sand with silt, SP-SM	TAN	NA	MST	4	OVA 0.0	Some slough
126	16			Silty sand, SM	ORANGE	NA	MST	11	OVA 0.0	
125	17									
124	18									
123	19									
122	20		100	Poorly graded sand with silt, SP-SM	ORANGE	NA	WET	21		

06/17/93

Page: 1 of 2

AR302462

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-08  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 142.000 estimated

TOTAL DEPTH : 27.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC  
 DRILLING RIG : ATV  
 DATE STARTED : 04/30/93  
 DATE COMPLETED : 04/30/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
121	21			Poorly graded sand with silt, SP-SM	ORANGE	NA	WET		OVA 0.0	
120	22									
119	23									
118	24									
117	25		100	Poorly graded sand with silt, SP-SM	ORANGE	NA	WET	3	OVA 0.0	Spoon taken prior to this one to remove running sands
116	26									
115	27			Fat clay, CH	ORANGE & LT. GRE	NA	MST			Orange & light grey varved clay
				Fat clay, CH	DARK GREY	NA	MST			
114	28									
113	29									
112	30									
111	31									
110	32									
109	33									
108	34									
107	35									
106	36									
105	37									
104	38									
103	39									
102	40									

AR302463

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-09  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 141.000 estimated

TOTAL DEPTH : 32.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC.  
 DRILLING RIG : ATV  
 DATE STARTED : 05/03/93  
 DATE COMPLETED : 05/03/93

ELEVATION	DEPTH	MATERIAL	* RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
140	1		80	Silty sand, SM	DARK BROWN	NA	MST	1	OVA 0.0	Topsoil - organic matter present.
				Silty sand, SM	TAN	NA	MST	1	OVA 0.0	
139	2									
138	3									
137	4									
136	5		100	Sandy silt, ML	LT. BROWN	NA	MST	4	OVA 0.0	3" of slough in top of spoon
135	6			Elastic silt with sand, MH	LT. BROWN	NA	MST	13	OVA 0.0	
				Lean clay with sand, CL	ORANGE & LT.GRY	NA	DRY		OVA 0.0	
134	7									
133	8									
132	9									
131	10		100	Sandy elastic silt, MH	LT. ORANGE	NA	MST	12	OVA 0.0	4" of slough in top of spoon
130	11			Silty sand, SM	ORANGE & LT.GRE	NA	MST	17	OVA 0.0	Varved clay
				Silty sand, SM	WHITE	NA	MST		OVA 0.0	
129	12			Silty sand, SM	LT. ORANGE	NA	MST		OVA 0.0	
128	13									
127	14									
126	15		90	Silty sand, SM	LT. ORANGE	NA	MST	4	OVA 0.0	Some slough
125	16			Poorly graded sand, SP	LT. TAN	NA	MST	7	OVA 0.0	
				Silty sand, SM	ORANGE & LT.GRE	NA	MST		OVA 0.0	Secondary lithology - see notes in book
124	17									
123	18									
122	19									
121	20		70	Silty sand, SM	ORANGE & LT GRY	NA	MST	14 22 65 51	OVA 0.0	

06/16/93

AR302464

Page: 1 of 2

# Borehole Log

ROY F. WESTON, Inc.

CLIENT : U.S. EPA  
 SITE NAME : SMWT-5670  
 WELL ID : B-09  
 NORTHING : 0.0000 estimated  
 EASTING : 0.0000 estimated  
 ELEVATION : 141.000 estimated

TOTAL DEPTH : 32.00  
 LOGGER : CHARLES MCCUSKER, RFW/REAC  
 DRILLING COMPANY : ATEC ASSOCIATES, INC.  
 DRILLING RIG : ATV  
 DATE STARTED : 05/03/93  
 DATE COMPLETED : 05/03/93

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
120	21			Silty sand, SM	ORANGE & LT GRY	NA	MST		OVA 0.0	
				Poorly graded sand, SP	DK. RED BRN RST	NA	WET		OVA 0.0	
119	22									
118	23									
117	24									
116	25		100	Fat clay, CH	ORANGE & LT GRY	NA	MST	2	OVA 0.0	Varved clay
115	26									
114	27									
113	28									
112	29									
111	30		100	Fat clay, CH	ORANGE & LT GRY	NA	MST	4	OVA 0.0	
110	31			Fat clay, CH	DRK GREY	NA	MST	4	OVA 0.0	seam of dark reddish brown wood like material (old root?), middle of unit
109	32									
108	33									
107	34									
106	35									
105	36									
104	37									
103	38									
102	39									
101	40									

AR302465

# Well Completion Summary

ROY F. WESTON, Inc.

CLIENT U.S. EPA DRILLING FIRM ATEC ASSOCIATES, INC  
SITE NAME SOUTHERN MARYLAND WT INSPECTOR CHARLES MCCUSKER

WELL ID ERT - 1 WATER LEVELS  
START DATE 05/03/93 16.82 FT (TOC) ON 05/05/93  
COMPLETION DATE 05/04/93

Protective Casing		DEPTH	ELEV.	DRILLING SUMMARY	
2.00 inch		1.83 TC	142.83	Driller	BILL KREINER
		0.00 GS	141.00	Drilling Fluid	NONE
				Well Type	SINGLE CASED SCREENED
<b>WELL DESIGN CONSTRUCTION</b>					
Casing #1 Diameter: 2.00 inch Interval: 0.00 to 10.71 ft. Type :					
Stick Up Inner Casing: 1.83 ft. Protective Casing: 2.14 ft.					
Casing Grout: PORTLAND CEMENT Interval: 0.00 to 4.50 ft.					
Seal Type: BENTONITE CHIPS Interval: 4.50 to 6.90 ft.					
Sand Pack Type : #2 SAND Interval: 6.90 to 32.00 ft. Grain Size : UNIFORM Median Diameter: Screen Diameter: 2.00 Interval: 10.71 to 30.71 ft. Type : PVC Slots: 0.010 inches					
Silt Trap Interval: 0.00 to 0.00 ft. Backfill Type : NONE Interval: 0.00 to 0.00 ft.					
<b>WELL DEVELOPMENT</b>					
Date 05/04/93 Method WATERRA PUMP Yield Purged Volume					
<b>COMMENTS</b>					
TC = Top of Casing SP = Top Sand Pack = Grout GS = Ground Surface SC = Top Screen = Seal BN = Top Seal BS = Bottom Screen = Sand Pack TD = Total Depth = Formation					
Additional Comments: Elevations are estimated (not surveyed)					

NOTE: Well Diagram not to Scale

Elevations are feet above mean sea level

06/17/93

AR302466

# Well Completion Summary

ROY F. WESTON, Inc.

CLIENT U.S. EPA DRILLING FIRM ATEC ASSOCIATES, INC  
SITE NAME SOUTHERN MARYLAND WT INSPECTOR CHARLES MCCUSKER

WELL ID ERT - 2 WATER LEVELS  
START DATE 04/29/93 20.66 FT (TOC) ON 05/05/93  
COMPLETION DATE 05/04/93

DEPTH		ELEV.	DRILLING SUMMARY	
Protective Casing	1.81	TC	146.81	Driller BILL KREINER
2.00 inch	0.00	GS	145.00	Drilling Fluid NONE
				Well Type SINGLE CASSED SCREENED
<b>WELL DESIGN CONSTRUCTION</b>				
Casing #1 Diameter: 2.00 inch Interval: 0.00 to 13.38 ft.				
Type :				
Stick Up Inner Casing: 1.81 ft. Protective Casing: 1.99 ft.				
Casing Grout: PORTLAND CEMENT Interval: 0.00 to 8.33 ft.				
Seal Type: BENTONITE CHIPS Interval: 8.33 to 11.00 ft.				
Sand Pack Type : #2 SAND Interval: 11.00 to 37.00 ft.				
Grain Size : UNIFORM Median Diameter:				
Screen Diameter: 2.00 Interval: 13.38 to 28.38 ft.				
Type : PVC Slots: 0.010 inches				
8.33	BN	136.67	Silt Trap Interval: 0.00 to 0.00 ft.	
11.00	SP	134.00	Backfill Type : #2 SAND Interval: 37.00 to 28.50 ft.	
13.38	SC	131.62	<b>WELL DEVELOPMENT</b>	
			Date 05/04/93	
			Method WATERRA PUMP	
			Yield Purged Volume	
<b>COMMENTS</b>				
TC = Top of Casing SP = Top Sand Pack = Grout				
GS = Ground Surface SC = Top Screen = Seal				
BN = Top Seal BS = Bottom Screen = Sand Pack				
TD = Total Depth = Formation				
28.38	BS	116.62	Additional Comments:	
37.00	TD	108.00	WELL PERMIT NO: SM-88-2469	
			ELEVATIONS ARE ESTIMATED (NOT SURVEYED)	

NOTE: Well Diagram not to Scale

Elevations are feet above mean sea level

06/17/93

AR302467

**APPENDIX B**

**Report of Geoprobe Investigation**

**Southern Maryland Woodtreating Site**

**Hollywood, MD**

**February 4, 1994**

AR302468



Roy F. Weston, Inc.  
GSA Raritan Depot  
Building 209 Annex (Bay F)  
2890 Woodbridge Avenue  
Edison, New Jersey 08837-3679  
908-321-4200 • Fax 908-494-4021

DATE: February 28, 1994

TO: Harry Allen, U.S. EPA/ERT Work Assignment Manager

Through: Gary Buchanan, REAC Section Chief *[Signature]*

FROM: Dan Crouse, REAC Task Leader *[Signature]*

Subject: SITE SAMPLING AND TREATABILITY STUDIES, SOUTHERN MARYLAND  
WOODTREATING SITE, HOLLYWOOD, MARYLAND WA # 5-670 - REVISED  
STATUS REPORT

Per your request, the Status Report for the Southern Maryland Woodtreating Site, dated October 16, 1992, has been revised to incorporate validated data. The text of the report has not changed, but the Tables have been updated to include the validated data.

Copy: Central File WA # 5-670 (w/ attachments)  
W. Scott Butterfield (w/o attachments)

SR101692.RV1

AR302469



REAC PROJECT  
GSA RARITAN DEPOT  
2890 WOODBRIDGE AVENUE  
BLDG. 209 ANNEX  
EDISON, NJ 08837-3679

DATE: October 16, 1992

TO: Harry Allen, U.S. EPA/ERT Work Assignment Manager

THRU: Gary Buchanan, REAC Section Chief *[Signature]*

FROM: Mary Lee, REAC Task Leader *[Signature]* for ML

SUBJECT: SOUTHERN MARYLAND WOODTREATING  
WORK ASSIGNMENT #3-670 - STATUS REPORT

#### BACKGROUND

The Southern Maryland Wood-Treating (SMWT) site is located in Hollywood, Saint Marys County, Maryland (Figure 1). The site is comprised of approximately 25 acres in the northwestern portion of a 96-acre property and is surrounded by residential and agricultural areas. Wood treatment operations were conducted on approximately four acres of the site (Figure 2).

The facility was owned and operated by Southern Maryland Woodtreating Company from 1965 to 1978 as a pressure treating facility for wood preservation. Creosote and pentachlorophenol (PCP) were used as wood preservatives at the facility. Wastes that were generated on the site included retort and cylinder sludges, process wastes, and material spillage. Six unlined lagoons were previously used for disposal of wastes. As a result of this practice, other areas including soils, groundwater, and sediments and surface water in an on-site freshwater pond became contaminated. The contaminants include volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), and other base, neutral, and acid extractable (BNA) compounds.

In an initial cleanup conducted by the Potentially Responsible Party (PRP) in 1982, the liquids from the lagoons were spray irrigated into the woods. The sludge from the six lagoons were excavated, mixed with wood chips and composted sewage sludge, and spread in a land treatment area on the southeastern section of the property. The areas excavated were backfilled and graded. These remedial actions were not successful and resulted in an increase of contaminated areas on the site. The freshwater pond was partially excavated in 1986 by the United States Environmental Protection Agency (U.S. EPA) as part of a removal action, and the sediments stockpiled under an impermeable liner.

A containment wall was constructed to enclose the highly contaminated areas which were delineated during the Remedial Investigation/Feasibility Study (RI/FS) report prepared by U.S. EPA in 1988. The areas of concern included the pond area, the excavated lagoon areas, and portions of the process and spray irrigation areas. The containment wall is constructed of sheet piles and extends into the clay layer that underlies the site. The purpose of the wall was to prevent further migration of the groundwater contaminant plume, contained within the wall, and to allow this area of the site to be dewatered so that the contaminated soils could be excavated for possible thermal treatment. The construction of the containment wall was overseen by the U.S. Army Corps of Engineers.

52302470

In August 1992, the U.S. EPA Environmental Response Team (ERT) tasked the Response Engineering and Analytical Contract (REAC) contractor to conduct the following tasks:

- o Determine the extent of contamination.
- o Determine the hydrogeology of the site by continuous coring with the Geoprobe.
- o Build four compost piles, two with a 20% amendment addition and nutrients added to the soil and two with no amendments.
- o Construct six land treatment cells using the contaminated soil and the compost sewage sludge found in the land treatment area.

#### OBSERVATIONS AND ACTIVITIES

Field work at the SMWT site commenced on August 31, 1992, when the initial site walkthrough was conducted and continued through the week of September 7, 1992. The site walkthrough determined the locations for the compost piles, the land treatment cells, and the Geoprobe locations. ERT/REAC determined that the compost piles would be constructed beneath the pole barn located within the sheetpiled containment area, and the land treatment cells would be constructed in-situ in the land treatment area. The Geoprobe sampling locations were along both sides of the containment wall (Figure 2). All soil and water samples were analyzed for pentachlorophenol (PCP) and creosote at the REAC high hazard laboratory in Brunswick, Georgia.

During the week of August 31, 1992, equipment and material required for the construction of the compost piles were ordered and delivered. Steel sheds were constructed to house the monitoring equipment and the water pump. The monitoring and watering system was set up to monitor the temperatures of the piles and to water the piles, respectively (Figure 3). The compost piles are monitored with two thermocouples and a soil moisture block in each pile, and the watering system is set on a timer to turn on for approximately five minutes each day.

Soil and water samples were collected from locations sampled with the Geoprobe. The locations were located on each side of the south side of the containment wall. The purpose of these sample locations is to determine whether the containment wall prevented the migration of the groundwater contaminant plume within the wall. (See Table 1 for results).

Two test pits were excavated to determine the depth of contamination in the land treatment area. Samples were taken at several depths. Visual inspection of the stratigraphy of one test pit indicated approximately 1.5 feet of sandy loam, 6 to 8 inches of compost sludge, and 6 to 8 inches of contaminated soil. The soil at approximately the 2 to 7 feet depth appeared to be a light brown silty sand, at 7 to 11 feet was a mottled clayed silt, at 11 to 12 feet was a light brown/yellow sand, at 12 feet was a cemented iron sand, at 15 feet was an orange yellow silty sand, and at 17.5 feet was a tan/white sand. (See Table 2 for results). As a result, six land treatment cells were constructed by excavating approximately 2 to 2.5 feet to the contaminated soil; mixing the soil with the compost sludge and loamy sand; and backfilling into the six cells. A geomembrane fabric was laid down in the cells prior to backfilling to differentiate between the soil being tested and the soil beneath the excavated material.

The six land treatment cells consisted of two control piles, with and without slow release nitrogen tablets (fertilizer); two aerated piles, with and without fertilizer; and two tilled piles, with and without fertilizer. The control piles and the aerated piles will not be turned during the 60-day study period. Samples have been collected on a 10-day period; however, after the 20th day sampling period was conducted, ERT decided that it would not be necessary to sample as frequently as every 10 days and that a 20-day sampling period would be sufficient. Soil samples are being analyzed for PCP, creosote, and nutrients. (See Table 3 and Table 4 for results of the day 0 and day 10 sampling events, respectively). The nutrient samples are being analyzed by Ross Analytical in Strongsville, Ohio. The nutrients consist of total Kjeldahl nitrogen, ammonia, nitrates, and organic and total phosphates.

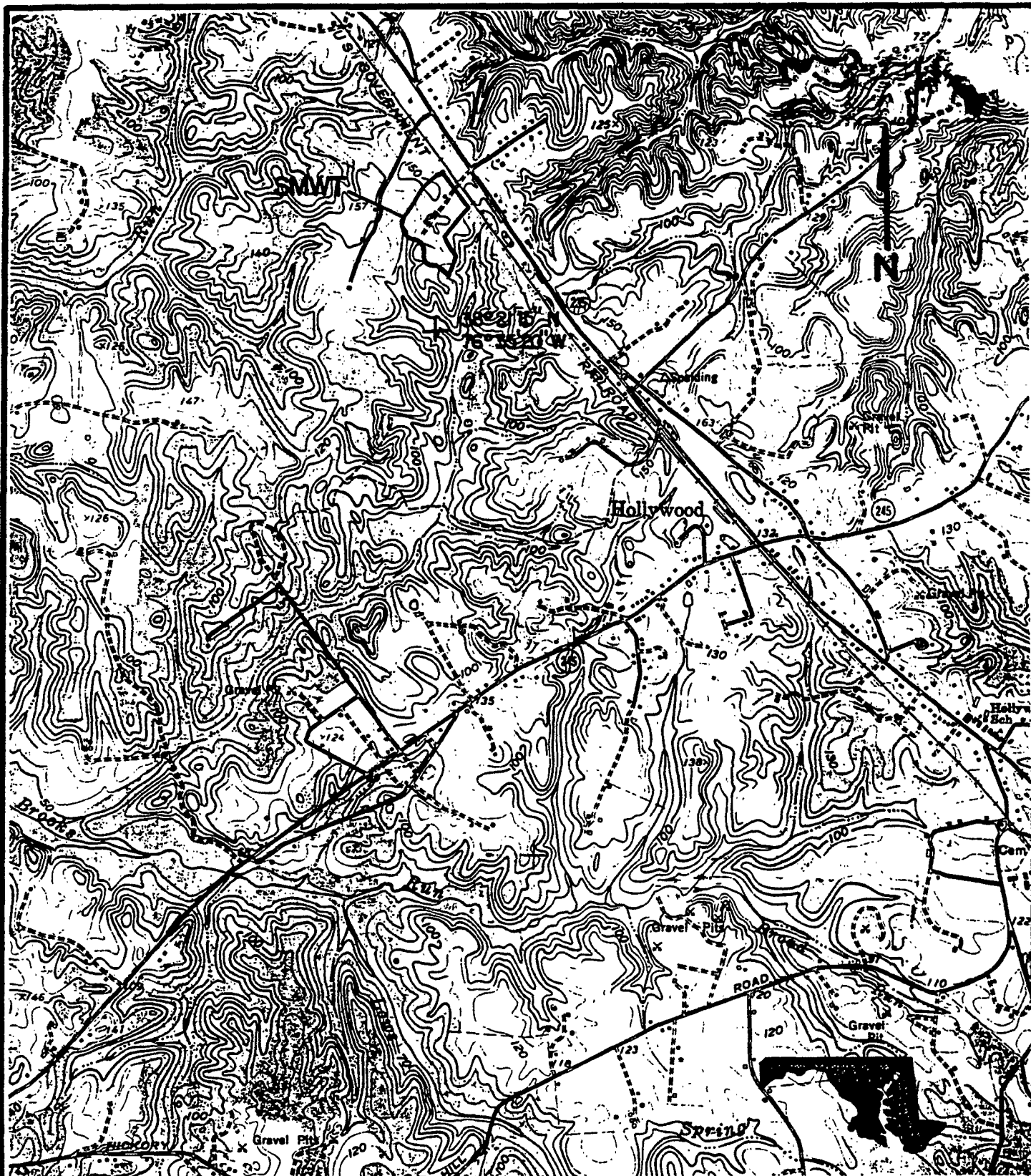
AR302471

The four compost piles were constructed under the pole barn area. Contaminated soil from the land treatment area was excavated and mixed with hay and cow manure to construct the piles. The piles consisted of two control piles, with and without fertilizer; and two piles amended with 20% manure and hay. One amended pile will be turned every 20 days and one pile is passively aerated. All piles with the exception of the aerated piles will be turned every 20 days. Samples were taken at day 0 and day 10. (See Table 5 and Table 6, respectively, for the results.)

#### FUTURE ACTIVITIES

The temperatures of the compost will be monitored daily by calling up the modem on site from REAC, and the watering system will continue to be operational until the end of the study which is estimated to be the end of 1992. The compost piles and the land treatment cells will be turned every 20 days, and samples for PCP, creosote, and nutrient analysis will also be collected. In late October, the water/oil interface probe will be used to determine whether a dense non-aqueous phase liquid exists in the monitoring wells within the containment area.

AR302472



SCALE 1:24,000

US EPA ENVIRONMENTAL RESPONSE TEAM

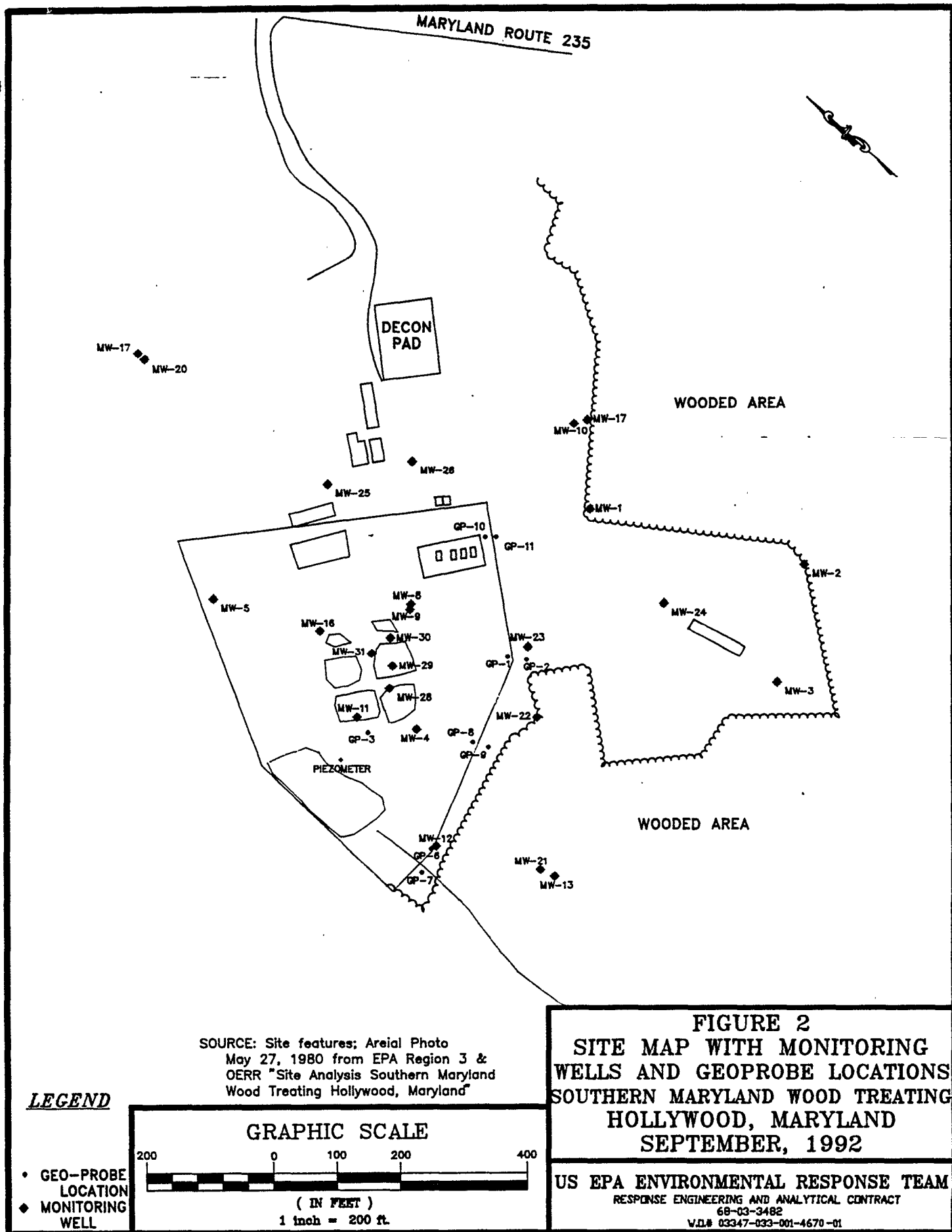
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

68-03-3482

W.D. 03347-033-001-4670-01

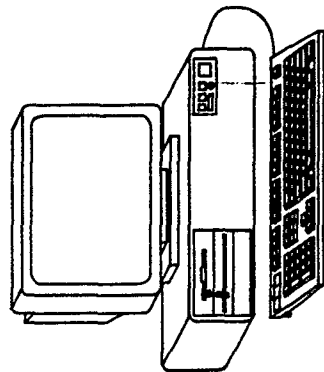
FIGURE 1  
SITE LOCATION MAP  
SOUTHERN MARYLAND WOOD TREATING  
HOLLYWOOD MARYLAND  
SEPTEMBER, 1992

AR302473



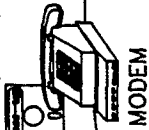
AR302474

# COMPUTER BASED DATA ACQUISITION AND PROCESS CONTROL SYSTEM



386 PC

REMOTE COMMUNICATION  
SOFTWARE (HOST)



MODEM

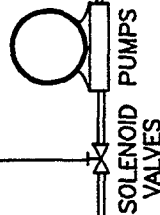
OMEGA DATA ACQUISITION AND  
PROCESS CONTROL SOFTWARE

386 PC

DATA ACQUISITION AND  
PROCESS CONTROL BOARD



WATER  
SUPPLY



SOLENOID PUMPS  
VALVES

MOISTURE PROBES

THERMOCOUPLES

BIOREMEDIATION BEDS

FIGURE 3

COMPUTER SYSTEM

SOUTHERN MARYLAND WOOD TREATING SITE

HOLLYWOOD, MD

MAY-SEPTEMBER, 1992

US EPA ENVIRONMENTAL RESPONSE TEAM

RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

69-02-3482

V.D.# 03347-003-001-4670-01

AR302475

**TABLE 1**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**GEOPROBE SAMPLING RESULTS**  
September, 1992

Client ID	A17018	A17017
Extract Dil. Factor	1.0	1.0
%Solid	44.0	85.0

LOCATION	GP-1 (20')	GP-2 (23'-25')
----------	------------	----------------

COMPOUND NAME	Conc.	MDL	Conc.	MDL
	mg/Kg		mg/Kg	

Naphthalene	ND	11.0	ND	5.7
Acenaphthene	ND	11.0	ND	5.7
Fluorene	ND	11.0	ND	5.7
Phenanthrene	ND	11.0	ND	5.7
Anthracene	ND	11.0	ND	5.7
Carbazole	ND	11.0	ND	5.7
Fluoranthene	ND	11.0	ND	5.7
Pyrene	ND	11.0	ND	5.7
Benzo(a)anthracene	ND	11.0	ND	5.7
Chrysene	ND	11.0	ND	5.7
Benzo(b)fluoranthene	ND	11.0	ND	5.7
Benzo(k)fluoranthene	ND	11.0	ND	5.7
Benzo(a)pyrene	ND	11.0	ND	5.7
TOTAL	ND		ND	

Pentachlorophenol	ND	11.0	ND	5.7
-------------------	----	------	----	-----

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the lowest linear standard and is estimated.

AR302476

**TABLE 1 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**GEOPROBE SAMPLING RESULTS**  
September, 1992

<b>Client ID</b>	A17019	A17021	A17022	A17020
<b>Extract Dil. Factor</b>	1.0	1.0	10.0	1.0
<b>%Solid</b>	86.0	73.0	85.0	84.0

LOCATION	GP-3 (8'-10')	GP-3 (14'-16')	GP-3 (12'-14')	GP-3 (10'-12')
----------	---------------	----------------	----------------	----------------

COMPOUND NAME	Conc.		Conc.		Conc.		Conc.	
	mg/Kg	MDL	mg/Kg	MDL	mg/Kg	MDL	mg/Kg	MDL
Naphthalene	1500.0	5.7	35.0	6.6	8600.0	57.0	2.2 J	5.7
Acenaphthene	600.0	5.7	21.0	6.6	3300.0	57.0	ND	5.7
Fluorene	390.0	5.7	13.0	6.6	2300.0	57.0	ND	5.7
Phenanthrene	1200.0	5.7	43.0	6.6	6600.0	57.0	ND	5.7
Anthracene	130.0	5.7	4.6 J	6.6	580.0	57.0	ND	5.7
Carbazole	42.0	5.7	ND	6.6	350.0	57.0	ND	5.7
Fluoranthene	590.0	5.7	20.0	6.6	3200.0	57.0	ND	5.7
Pyrene	400.0	5.7	14.0	6.6	2300.0	57.0	ND	5.7
Benzo(a)anthracene	110.0	5.7	3.3 J	6.6	520.0	57.0	ND	5.7
Chrysene	83.0	5.7	2.8 J	6.6	400.0	57.0	ND	5.7
Benzo(b)fluoranthene	38.0	5.7	ND	6.6	170.0	57.0	ND	5.7
Benzo(k)fluoranthene	41.0	5.7	ND	6.6	190.0	57.0	ND	5.7
Benzo(a)pyrene	39.0	5.7	ND	6.6	180.0	57.0	ND	5.7
<b>TOTAL</b>	5163.0		152.1		28690.0		2.2	

Pentachlorophenol	10.0	5.7	ND	6.6	59.0 J	57.0	ND	5.7
-------------------	------	-----	----	-----	--------	------	----	-----

ND - The compound was analyzed for but not detected at or below the detection limit.

J - Denotes that the result is less than the lowest linear standard and is estimated.

AR302477

**TABLE 1 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**GEOPROBE SAMPLING RESULTS**  
September, 1992

<b>Client ID</b>	A17015	A17014	A17013
<b>Extract Dil. Factor</b>	1.0	1.0	1.0
<b>%Solid</b>	84.0	79.0	75.0

<b>LOCATION</b>	<b>GP-6(2.5'-4.5')</b>	<b>GP-7(2'-4')</b>	<b>GP-7 (27'-29')</b>
-----------------	------------------------	--------------------	-----------------------

<b>COMPOUND NAME</b>	<b>Conc. mg/Kg</b>	<b>MDL</b>	<b>Conc. mg/Kg</b>	<b>MDL</b>	<b>Conc. mg/Kg</b>	<b>MDL</b>
----------------------	------------------------	------------	------------------------	------------	------------------------	------------

Naphthalene	ND	5.7	4.7 J	6.2	ND	6.4
Acenaphthene	ND	5.7	ND	6.2	ND	6.4
Fluorene	ND	5.7	ND	6.2	ND	6.4
Phenanthrene	ND	5.7	ND	6.2	ND	6.4
Anthracene	ND	5.7	ND	6.2	ND	6.4
Carbazole	ND	5.7	ND	6.2	ND	6.4
Fluoranthene	ND	5.7	ND	6.2	ND	6.4
Pyrene	ND	5.7	ND	6.2	ND	6.4
Benzo(a)anthracene	ND	5.7	ND	6.2	ND	6.4
Chrysene	ND	5.7	ND	6.2	ND	6.4
Benzo(b)fluoranthene	ND	5.7	ND	6.2	ND	6.4
Benzo(k)fluoranthene	ND	5.7	ND	6.2	ND	6.4
Benzo(a)pyrene	ND	5.7	ND	6.2	ND	6.4

<b>TOTAL</b>	ND		4.7		ND	
--------------	----	--	-----	--	----	--

Pentachlorophenol	ND	5.7	ND	6.2	ND	6.4
-------------------	----	-----	----	-----	----	-----

ND – The compound was analyzed for but not detected at or below the detection limit.  
J – Denotes that the result is less than the lowest linear standard and is estimated.

AR302478

**TABLE 1 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**GEOPROBE SAMPLING RESULTS**  
September, 1992

<b>Client ID</b>	A17016	A17003	A17001	A17002
<b>Extract Dil. Factor</b>	1.0	1.0	1.0	1.0
<b>%Solid</b>	83.0	80.0	82.0	88.0

<b>LOCATION</b>	GP-8(23'-25')	GP-9 (26.5'-27.5')	GP-10 (32.9'-34.9')	GP-11 (24.8'-26.8')
-----------------	---------------	--------------------	---------------------	---------------------

<b>COMPOUND NAME</b>	<b>Conc. mg/Kg</b>	<b>MDL</b>	<b>Conc. mg/Kg</b>	<b>MDL</b>	<b>Conc. mg/Kg</b>	<b>MDL</b>	<b>Conc. mg/Kg</b>	<b>MDL</b>
----------------------	------------------------	------------	------------------------	------------	------------------------	------------	------------------------	------------

Naphthalene	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Acenaphthene	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Fluorene	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Phenanthrene	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Anthracene	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Carbazole	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Fluoranthene	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Pyrene	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Benzo(a)anthracene	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Chrysene	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Benzo(b)fluoranthene	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Benzo(k)fluoranthene	ND	5.8	ND	6.1	ND	5.9	ND	5.5
Benzo(a)pyrene	ND	5.8	ND	6.1	ND	5.9	ND	5.5

<b>TOTAL</b>	ND		ND		ND		ND	
--------------	----	--	----	--	----	--	----	--

Pentachlorophenol	ND	5.8	ND	6.1	ND	5.9	ND	5.5
-------------------	----	-----	----	-----	----	-----	----	-----

ND - The compound was analyzed for but not detected at or below the detection limit.  
J - Denotes that the result is less than the lowest linear standard and is estimated.

AR302479

**TABLE 2**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**TEST PIT #1**  
September, 1992

<b>Client ID</b>	A17006	A17007	A17008	A17009
<b>Extract Dil. Factor</b>	10.0	10.0	1.0	1.0
<b>%Solid</b>	87.0	88.0	93.0	92.0

LOCATION	Excavation	1'	2'	3'
----------	------------	----	----	----

COMPOUND NAME	Conc.		Conc.		Conc.		Conc.	
	mg/Kg	MDL	mg/Kg	MDL	mg/Kg	MDL	mg/Kg	MDL

Naphthalene	890.0	57.0	1100.0	55.0	ND	5.2	ND	5.2
Acenaphthene	2100.0	57.0	1600.0	55.0	ND	5.2	ND	5.2
Fluorene	2300.0	57.0	1800.0	55.0	ND	5.2	ND	5.2
Phenanthrene	6200.0	57.0	4100.0	55.0	ND	5.2	ND	5.2
Anthracene	4800.0	57.0	3900.0	55.0	ND	5.2	ND	5.2
Carbazole	1400.0	57.0	1700.0	55.0	ND	5.2	ND	5.2
Fluoranthene	2500.0	57.0	2000.0	55.0	ND	5.2	ND	5.2
Pyrene	1700.0	57.0	1400.0	55.0	ND	5.2	ND	5.2
Benzo(a)anthracene	400.0	57.0	320.0	55.0	ND	5.2	ND	5.2
Chrysene	420.0	57.0	350.0	55.0	ND	5.2	ND	5.2
Benzo(b)fluoranthene	130.0	57.0	110.0	55.0	ND	5.2	ND	5.2
Benzo(k)fluoranthene	140.0	57.0	110.0	55.0	ND	5.2	ND	5.2
Benzo(a)pyrene	120.0	57.0	92.0	55.0	ND	5.2	ND	5.2

<b>TOTAL</b>	23100.0		18582.0		ND		ND	
--------------	---------	--	---------	--	----	--	----	--

Pentachlorophenol	170.0	57.0	130.0	55.0	ND	5.2	ND	5.2
-------------------	-------	------	-------	------	----	-----	----	-----

ND – The compound was analyzed for but not detected at or below the detection limit.

**TABLE 2 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
 Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
 results based on dry weight of soil  
**TEST PIT #2**  
 September, 1992

<b>Client ID</b>	A09574	A09575
<b>Extract Dil. Factor</b>	1.0	1.0
<b>%Solid</b>	90.0	93.0

<b>LOCATION</b>	<b>16'</b>	<b>18'</b>
-----------------	------------	------------

COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL
Naphthalene	ND	5.4	ND	5.4
Acenaphthene	ND	5.4	ND	5.4
Fluorene	ND	5.4	ND	5.4
Phenanthrene	ND	5.4	ND	5.4
Anthracene	ND	5.4	ND	5.4
Carbazole	ND	5.4	ND	5.4
Fluoranthene	ND	5.4	ND	5.4
Pyrene	ND	5.4	ND	5.4
Benzo(a)anthracene	ND	5.4	ND	5.4
Chrysene	ND	5.4	ND	5.4
Benzo(b)fluoranthene	ND	5.4	ND	5.4
Benzo(k)fluoranthene	ND	5.4	ND	5.4
Benzo(a)pyrene	ND	5.4	ND	5.4
<b>TOTAL</b>	ND		ND	
Pentachlorophenol	ND	5.4	ND	5.4

ND – The compound was analyzed for but not detected at or below the detection limit.

AR302481

**TABLE 3**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**LAND TREATMENT TEST CELLS 1,2,3,4,5 & 6 (Day 0)**  
September, 1992

Client ID	A17041	A17042	A17043
Extract Dil. Factor	1.0	1.0	1.0
%Solid	74.0	74.0	76.0

LOCATION	LTC1-To	LTC2-To	LTC3-To
----------	---------	---------	---------

COMPOUND NAME	Conc.		Conc.		Conc.	
	mg/Kg	MDL	mg/Kg	MDL	mg/Kg	MDL
Naphthalene	110.0	6.6	200.0	6.6	130.0	6.5
Acenaphthene	73.0	6.6	140.0	6.6	66.0	6.5
Fluorene	67.0	6.6	130.0	6.6	79.0	6.5
Phenanthrene	190.0	6.6	340.0	6.6	210.0	6.5
Anthracene	120.0	6.6	240.0	6.6	280.0	6.5
Carbazole	41.0	6.6	78.0	6.6	110.0	6.5
Fluoranthene	80.0	6.6	160.0	6.6	74.0	6.5
Pyrene	54.0	6.6	100.0	6.6	48.0	6.5
Benzo(a)anthracene	13.0	6.6	25.0	6.6	12.0	6.5
Chrysene	17.0	6.6	31.0	6.6	15.0	6.5
Benzo(b)fluoranthene	5.8 J	6.6	11.0	6.6	5.0 J	6.5
Benzo(k)fluoranthene	6.3 J	6.6	12.0	6.6	5.7 J	6.5
Benzo(a)pyrene	5.1 J	6.6	9.8	6.6	4.1 J	6.5
TOTAL	782.2		1476.8		1038.8	

Pentachlorophenol	7.5	6.6	18	6.6	7.5	6.5
-------------------	-----	-----	----	-----	-----	-----

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the lowest linear standard and is estimated.

AR302482

**TABLE 3 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**LAND TREATMENT CELLS 1,2,3,4,5 & 6 (Day 0) (continued)**

<b>Client ID</b>	A17044	A17045	A17046
<b>Extract Dil. Factor</b>	1.0	1.0	1.0
<b>%Solid</b>	80.0	77.0	77.0

LOCATION	LTC4-To	LTC5-To	LTC6-To
----------	---------	---------	---------

COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL
---------------	----------------	-----	----------------	-----	----------------	-----

Naphthalene	830.0	6.1	160.0	6.3	180.0	6.2
Acenaphthene	480.0	6.1	120.0	6.3	120.0	6.2
Fluorene	470.0	6.1	120.0	6.3	120.0	6.2
Phenanthrene	1300.0	6.1	310.0	6.3	320.0	6.2
Anthracene	960.0	6.1	260.0	6.3	250.0	6.2
Carbazole	180.0	6.1	79.0	6.3	83.0	6.2
Fluoranthene	520.0	6.1	150.0	6.3	140.0	6.2
Pyrene	340.0	6.1	98.0	6.3	92.0	6.2
Benzo(a)anthracene	93.0	6.1	24.0	6.3	22.0	6.2
Chrysene	110.0	6.1	28.0	6.3	28.0	6.2
Benzo(b)fluoranthene	41.0	6.1	10.0	6.3	9.7	6.2
Benzo(k)fluoranthene	45.0	6.1	10.0	6.3	10.0	6.2
Benzo(a)pyrene	39.0	6.1	8.6	6.3	8.8	6.2

<b>TOTAL</b>	5408.0		1377.6		1383.5	
--------------	--------	--	--------	--	--------	--

Pentachlorophenol	66.0	6.1	17.0	6.3	12.0	6.2
-------------------	------	-----	------	-----	------	-----

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the lowest linear standard and is estimated.

AR302483

**TABLE 4**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
Average Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**LAND TREATMENT CELL #1 (Day 10)**  
September, 1992

Client ID	A17064	A17065	A17066
Extract Dil. Factor	1.0	1.0	1.0
% Solid	80.0	80.0	79.0

LOCATION	LEFT		CENTER		RIGHT		
COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	AVG. Conc. mg/Kg
Naphthalene	38.0 J	61.0	85.0	5.2	610.0	58.0	244.3
Acenaphthene	260.0	61.0	130.0	5.2	370.0	58.0	253.3
Fluorene	260.0	61.0	120.0	5.2	420.0	58.0	266.7
Phenanthrene	670.0	61.0	290.0	5.2	1100.0	58.0	686.7
Anthracene	680.0	61.0	250.0	5.2	1100.0	58.0	676.7
Carbazole	150.0	61.0	74.0	5.2	380.0	58.0	201.3
Fluoranthene	350.0	61.0	190.0	5.2	400.0	58.0	313.3
Pyrene	240.0	61.0	110.0	5.2	240.0	58.0	196.7
Benzo(a)anthracene	63.0	61.0	29.0	5.2	72.0	58.0	54.7
Chrysene	81.0	61.0	32.0	5.2	140.0	58.0	84.3
Benzo(b)fluoranthene	27.0 J	61.0	12.0	5.2	28.0 J	58.0	22.3
Benzo(k)fluoranthene	30.0 J	61.0	13.0	5.2	30.0 J	58.0	24.3
Benzo(a)pyrene	29.0 *	6.1 *	12.0	5.2	27.0 J	58.0	22.7
<b>TOTAL</b>	2878.0		1347.0		4917.0		3047.3
Pentachlorophenol	21.0 *	6.1 *	7.9	5.2	22.0 *	5.8 *	17.1

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the lowest linear standard and is estimated.

\* – Denotes that these values were taken from a different dilution.

AR302484

**TABLE 4 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**

Concentration Reported in mg/Kg

Average Concentration Reported in mg/Kg

**SOUTHERN MARYLAND WOODTREATING SITE**

results based on dry weight of soil

**LAND TREATMENT CELL #2 (Day 10)**

September, 1992

<b>Client ID</b>	A17067	A17068	A17069
<b>Extract Dil. Factor</b>	1.0	1.0	1.0
<b>% Solid</b>	82.0	85.0	82.0

LOCATION	LEFT	CENTER	RIGHT
----------	------	--------	-------

COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	AVG. Conc. mg/Kg
---------------	----------------	-----	----------------	-----	----------------	-----	---------------------

Naphthalene	24.0	5.7	13.0	5.5	100.0	5.6	45.7
Acenaphthene	270.0	5.7	250.0	5.5	230.0	5.6	250.0
Fluorene	290.0	5.7	230.0	5.5	220.0	5.6	246.7
Phenanthrene	570.0 *	57.0 *	650.0 *	55.0 *	480.0 *	56.0 *	566.7
Anthracene	450.0 *	57.0 *	730.0 *	55.0 *	350.0	5.6	510.0
Carbazole	93.0	5.7	100.0	5.5	120.0	5.6	104.3
Fluoranthene	210.0	5.7	500.0 *	55.0 *	290.0	5.6	333.3
Pyrene	120.0	5.7	190.0	5.5	170.0	5.6	160.0
Benzo(a)anthracene	57.0	5.7	86.0	5.5	48.0	5.6	63.7
Chrysene	62.0	5.7	100.0	5.5	60.0	5.6	74.0
Benzo(b)fluoranthene	21.0	5.7	37.0	5.5	20.0	5.6	26.0
Benzo(k)fluoranthene	22.0	5.7	39.0	5.5	21.0	5.6	27.3
Benzo(a)pyrene	20.0	5.7	35.0	5.5	19.0	5.6	24.7
<b>TOTAL</b>	2209.0		2960.0		2128.0		2432.3

Pentachlorophenol	33.0	5.7	40.0	5.5	17.0	5.6	30.0
-------------------	------	-----	------	-----	------	-----	------

ND -- The compound was analyzed for but not detected at or below the detection limit.

J -- Denotes that the result is less than the lowest linear standard and is estimated.

\* -- Denotes that these values were taken from a different dilution.

AR302485

**TABLE 4 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**

Concentration Reported in mg/Kg

Average Concentration Reported in mg/Kg

**SOUTHERN MARYLAND WOODTREATING SITE**

results based on dry weight of soil

**LAND TREATMENT CELL #3 (Day 10)**

September, 1992

<b>Client ID</b>	A17070	A17071	A17072
<b>Extract Dil. Factor</b>	1.0	1.0	1.0
<b>% Solid</b>	83.0	83.0	81.0

LOCATION	LEFT	CENTER	RIGHT
----------	------	--------	-------

COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	AVG. Conc. mg/Kg
---------------	----------------	-----	----------------	-----	----------------	-----	---------------------

Naphthalene	17.0 *	5.9 *	110.0	59.0	84.0	5.8	70.3
Acenaphthene	330.0	59.0	340.0	59.0	280.0	5.8	316.7
Fluorene	310.0	59.0	320.0	59.0	230.0	5.8	286.7
Phenanthrene	800.0	59.0	930.0	59.0	670.0 *	58.0 *	800.0
Anthracene	840.0	59.0	680.0	59.0	660.0 *	58.0 *	726.7
Carbazole	200.0	59.0	180.0	59.0	180.0	5.8	186.7
Fluoranthene	480.0	59.0	380.0	59.0	170.0	5.8	343.3
Pyrene	320.0	59.0	250.0	59.0	100.0	5.8	223.3
Benzo(a)anthracene	76.0	59.0	62.0	59.0	51.0	5.8	63.0
Chrysene	96.0	59.0	81.0	59.0	60.0	5.8	79.0
Benzo(b)fluoranthene	36.0 *	5.9 *	27.0 *	5.9 *	18.0	5.8	27.0
Benzo(k)fluoranthene	40.0 *	5.9 *	31.0 *	5.9 *	20.0	5.8	30.3
Benzo(a)pyrene	34.0 *	5.9 *	26.0 *	5.9 *	18.0	5.8	26.0
<b>TOTAL</b>	3579.0		3417.0		2541.0		3179.0

Pentachlorophenol	58.0 *	5.9 *	47.0 *	5.9 *	21.0	5.8	42.0
-------------------	--------	-------	--------	-------	------	-----	------

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the lowest linear standard and is estimated.

\* – Denotes that these values were taken from a different dilution.

AR302486

**TABLE 4 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
Average Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**LAND TREATMENT CELL #4 (Day 10)**  
September, 1992

Client ID	A17073	A17074	A17075
Extract Dil. Factor	1.0	1.0	1.0
% Solid	88.0	83.0	84.0

LOCATION	LEFT	CENTER	RIGHT
----------	------	--------	-------

COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	AVG. Conc. mg/Kg
---------------	----------------	-----	----------------	-----	----------------	-----	---------------------

Naphthalene	12.0 *	5.3 *	8.0	6.0	9.9	5.7	10.0
Acenaphthene	250.0	53.0	240.0	6.0	330.0	5.7	273.3
Fluorene	200.0	53.0	200.0	6.0	280.0	5.7	226.7
Phenanthrene	520.0	53.0	400.0	6.0	790.0 *	57.0 *	570.0
Anthracene	650.0	53.0	470.0	6.0	660.0 *	57.0 *	593.3
Carbazole	130.0	53.0	130.0	6.0	110.0	5.7	123.3
Fluoranthene	470.0	53.0	320.0	6.0	270.0	5.7	353.3
Pyrene	320.0	53.0	220.0	6.0	160.0	5.7	233.3
Benzo(a)anthracene	71.0	53.0	57.0	6.0	76.0	5.7	68.0
Chrysene	94.0	53.0	66.0	6.0	87.0	5.7	82.3
Benzo(b)fluoranthene	34.0 *	5.3 *	22.0	6.0	30.0	5.7	28.7
Benzo(k)fluoranthene	38.0 *	5.3 *	24.0	6.0	33.0	5.7	31.7
Benzo(a)pyrene	33.0 *	5.3 *	22.0	6.0	29.0	5.7	28.0

<b>TOTAL</b>	2822.0		2179.0		2864.9		2622.0
--------------	--------	--	--------	--	--------	--	--------

Pentachlorophenol	46.0 *	5.3 *	27.0	6.0	35.0	5.7	36.0
-------------------	--------	-------	------	-----	------	-----	------

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the lowest linear standard and is estimated.

\* – Denotes that these values were taken from a different dilution.

AR302487

**TABLE 4 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
Average Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**LAND TREATMENT CELL #5 (Day 10)**  
September, 1992

<b>Client ID</b>	A17076	A17077	A17078
<b>Extract Dil. Factor</b>	1.0	1.0	1.0
<b>% Solid</b>	80.0	84.0	80.0

LOCATION	LEFT	CENTER	RIGHT
----------	------	--------	-------

COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	AVG. Conc. mg/Kg
Naphthalene	160.0	5.9	160.0	5.5	160.0	6.2	160.0
Acenaphthene	300.0	5.9	280.0	5.5	240.0	6.2	273.3
Fluorene	230.0	5.9	240.0	5.5	230.0	6.2	233.3
Phenanthrene	670.0	5.9	700.0 *	55.0 *	560.0	6.2	643.3
Anthracene	490.0	5.9	470.0	5.5	420.0	6.2	460.0
Carbazole	180.0	5.9	95.0	5.5	150.0	6.2	141.7
Fluoranthene	290.0	5.9	220.0 *	55.0 *	270.0	6.2	260.0
Pyrene	190.0	5.9	170.0	5.5	230.0	6.2	196.7
Benzo(a)anthracene	55.0	5.9	560.0	5.5	49.0	6.2	221.3
Chrysene	69.0	5.9	700.0	5.5	60.0	6.2	276.3
Benzo(b)fluoranthene	20.0	5.9	230.0	5.5	20.0	6.2	90.0
Benzo(k)fluoranthene	24.0	5.9	220.0	5.5	20.0	6.2	88.0
Benzo(a)pyrene	21.0	5.9	190.0	5.5	17.0	6.2	76.0
<b>TOTAL</b>	2699.0		4235.0		2426.0		3120.0

Pentachlorophenol	25.0	5.9	120.0	5.5	31.0	6.2	58.7
-------------------	------	-----	-------	-----	------	-----	------

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the lowest linear standard and is estimated.

\* – Denotes that these values were taken from a different dilution.

AR302488

**TABLE 4 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**

Concentration Reported in mg/Kg

Average Concentration Reported in mg/Kg

**SOUTHERN MARYLAND WOODTREATING SITE**

results based on dry weight of soil

**LAND TREATMENT CELL #6 (Day 10)**

September, 1992

<b>Client ID</b>	A17079	A17080	A17081
<b>Extract Dil. Factor</b>	1.0	1.0	1.0
<b>% Solid</b>	82.0	82.0	78.0

LOCATION	LEFT	CENTER	RIGHT
----------	------	--------	-------

COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	AVG. Conc. mg/Kg
---------------	----------------	-----	----------------	-----	----------------	-----	---------------------

Naphthalene	53.0	6.0	8.3	6.0	20.0	5.9	27.1
Acenaphthene	270.0	6.0	240.0	6.0	280.0	5.9	263.3
Fluorene	230.0	6.0	210.0	6.0	250.0	5.9	230.0
Phenanthrene	550.0 *	60.0 *	470.0	6.0	710.0 *	59.0 *	576.7
Anthracene	460.0 *	60.0 *	490.0 *	60.0 *	690.0 *	59.0 *	546.7
Carbazole	77.0	6.0	140.0	6.0	130.0	5.9	115.7
Fluoranthene	370.0	6.0	300.0	6.0	410.0 *	59.0 *	360.0
Pyrene	180.0	6.0	260.0	6.0	220.0	5.9	220.0
Benzo(a)anthracene	64.0	6.0	53.0	6.0	75.0	5.9	64.0
Chrysene	66.0	6.0	65.0	6.0	86.0	5.9	72.3
Benzo(b)fluoranthene	26.0	6.0	23.0	6.0	32.0	5.9	27.0
Benzo(k)fluoranthene	28.0	6.0	23.0	6.0	34.0	5.9	28.3
Benzo(a)pyrene	23.0	6.0	19.0	6.0	28.0	5.9	23.3

<b>TOTAL</b>	2397.0		2301.3		2965.0		2554.4
--------------	--------	--	--------	--	--------	--	--------

Pentachlorophenol	48.0	6.0	32.0	6.0	51.0	5.2	43.7
-------------------	------	-----	------	-----	------	-----	------

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the linear standard and is estimated.

\* – Denotes that these values were taken from a different dilution.

AR302489

**TABLE 5**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**COMPOST PILES 1,2,3 & 4 (Day 0)**  
September, 1992

<b>Client ID</b>	A17036	A17037	A17038	A17039
<b>Extract Dil. Factor</b>	1.0	1.0	1.0	1.0
<b>%Solid</b>	84.0	85.0	72.0	79.0

LOCATION	Compost 1-To	Compost 2-To	Compost 3-To	Compost 4-To
----------	--------------	--------------	--------------	--------------

COMPOUND NAME	Conc.		Conc.		Conc.		Conc.	
	mg/Kg	MDL	mg/Kg	MDL	mg/Kg	MDL	mg/Kg	MDL

Naphthalene	680.0	59.0	710.0	59.0	390.0	68.0	140.0	60.0
Acenaphthene	650.0	59.0	780.0	59.0	510.0	68.0	310.0	60.0
Fluorene	620.0	59.0	750.0	59.0	420.0	68.0	220.0	60.0
Phenanthrene	1600.0	59.0	1900.0	59.0	1000.0	68.0	510.0	60.0
Anthracene	1900.0	59.0	2400.0	59.0	1300.0	68.0	810.0	60.0
Carbazole	520.0	59.0	640.0	59.0	340.0	68.0	150.0	60.0
Fluoranthene	880.0	59.0	1100.0	59.0	800.0	68.0	560.0	60.0
Pyrene	590.0	59.0	710.0	59.0	550.0	68.0	390.0	60.0
Benzo(a)anthracene	140.0	59.0	170.0	59.0	120.0	68.0	88.0	60.0
Chrysene	230.0	59.0	230.0	59.0	170.0	68.0	130.0	60.0
Benzo(b)fluoranthene	68.0	59.0	81.0	59.0	62.0 J	68.0	48.0 J	60.0
Benzo(k)fluoranthene	68.0	59.0	83.0	59.0	64.0 J	68.0	47.0 J	60.0
Benzo(a)pyrene	55.0 J	59.0	66.0	59.0	50.0 J	68.0	41.0 J	60.0

<b>TOTAL</b>	8001.0		9620.0		5776.0		3444.0	
--------------	--------	--	--------	--	--------	--	--------	--

Pentachlorophenol	43.0 J	59.0	58.0	59.0	58.0 J	68.0	53.0	60.0
-------------------	--------	------	------	------	--------	------	------	------

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the lowest standard and is estimated.

AR302490

**TABLE 6**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
 Concentration Reported in mg/Kg  
 Average Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
 results based on dry weight of soil  
**COMPOST PILE #1 (Day 10)**  
 September, 1992

Client ID	A17052	A17053	A17054
Extract Dil. Factor	1.0	1.0	1.0
% Solid	87.0	83.0	86.0

LOCATION	LEFT		CENTER		RIGHT		
COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	AVG. Conc. mg/Kg
Naphthalene	20.0 J	54.0	27.0 J	53.0	48.0 J	50.0	31.7
Acenaphthene	470.0	54.0	570.0	53.0	450.0	50.0	496.7
Fluorene	430.0	54.0	570.0	53.0	400.0	50.0	466.7
Phenanthrene	980.0	54.0	1300.0	53.0	880.0	50.0	1053.3
Anthracene	1500.0	54.0	1700.0	53.0	1500.0	50.0	1566.7
Carbazole	270.0	54.0	340.0	53.0	270.0	50.0	293.3
Fluoranthene	800.0	54.0	840.0	53.0	760.0	50.0	800.0
Pyrene	490.0	54.0	500.0	53.0	480.0	50.0	490.0
Benzo(a)anthracene	120.0	54.0	140.0	53.0	120.0	50.0	126.7
Chrysene	160.0	54.0	180.0	53.0	170.0	50.0	170.0
Benzo(b)fluoranthene	55.0	54.0	55.0	53.0	53.0	50.0	54.3
Benzo(k)fluoranthene	57.0	54.0	55.0	53.0	57.0	50.0	56.3
Benzo(a)pyrene	48.0 J	54.0	45.0 J	53.0	48.0 J	50.0	47.0
<b>TOTAL</b>	5400.0		6322.0		5236.0		5652.7
Pentachlorophenol	18.0 J	54.0	13.0 J	53.0	15.0 J	50.0	15.3

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the lowest linear standard and is estimated.

\* – Denotes that these values were taken from a different dilution.

AR302491

**TABLE 6 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**

Concentration Reported in mg/Kg

Average Concentration Reported in mg/Kg

**SOUTHERN MARYLAND WOODTREATING SITE**

results based on dry weight of soil

**COMPOST PILE #2 (Day 10)**

September, 1992

Client ID	A17055	A17056	A17057
Extract Dil. Factor	1.0	1.0	1.0
% Solid	80.0	81.0	82.0

LOCATION	LEFT	CENTER	RIGHT
----------	------	--------	-------

COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	AVG. Conc. mg/Kg
---------------	----------------	-----	----------------	-----	----------------	-----	---------------------

Naphthalene	18.0 J	59.0	25.0 J	59.0	120.0	58.0	54.3
Acenaphthene	570.0	59.0	490.0	59.0	770.0	58.0	610.0
Fluorene	350.0	59.0	430.0	59.0	790.0	58.0	523.3
Phenanthrene	720.0	59.0	940.0	59.0	1900.0	58.0	1186.7
Anthracene	1500.0	59.0	1700.0	59.0	2300.0	58.0	1833.3
Carbazole	180.0	59.0	330.0	59.0	490.0	58.0	333.3
Fluoranthene	1200.0	59.0	870.0	59.0	1100.0	58.0	1056.7
Pyrene	770.0	59.0	540.0	59.0	690.0	58.0	666.7
Benzo(a)anthracene	180.0	59.0	140.0	59.0	180.0	58.0	166.7
Chrysene	240.0	59.0	190.0	59.0	230.0	58.0	220.0
Benzo(b)fluoranthene	75.0	59.0	71.0	59.0	70.0	58.0	72.0
Benzo(k)fluoranthene	76.0	59.0	68.0	59.0	75.0	58.0	73.0
Benzo(a)pyrene	74.0	59.0	59.0	59.0	63.0	58.0	65.3

<b>TOTAL</b>	5953.0		5853.0		8778.0		6861.3
--------------	--------	--	--------	--	--------	--	--------

Pentachlorophenol	36.0 J	59.0	20.0 J	59.0	23.0 J	58.0	26.3
-------------------	--------	------	--------	------	--------	------	------

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the lowest linear standard and is estimated.

\* – Denotes that these values were taken from a different dilution.

AR302492

**TABLE 6 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**  
Concentration Reported in mg/Kg  
Average Concentration Reported in mg/Kg  
**SOUTHERN MARYLAND WOODTREATING SITE**  
results based on dry weight of soil  
**COMPOST PILE #3 (Day 10)**  
September, 1992

Client ID	A17058	A17059	A17060
Extract Dil. Factor	1.0	1.0	1.0
% Solid	84.0	88.0	87.0

LOCATION	LEFT	CENTER	RIGHT
----------	------	--------	-------

COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	AVG. Conc. mg/Kg
---------------	----------------	-----	----------------	-----	----------------	-----	---------------------

Naphthalene	10.0 *	5.2	30.0 J	54.0	97.0	55.0	45.7
Acenaphthene	500.0	52.0	470.0	54.0	410.0	55.0	460.0
Fluorene	430.0	52.0	400.0	54.0	310.0	55.0	380.0
Phenanthrene	1000.0	52.0	970.0	54.0	640.0	55.0	870.0
Anthracene	1400.0	52.0	1300.0	54.0	1200.0	55.0	1300.0
Carbazole	300.0	52.0	290.0	54.0	210.0	55.0	266.7
Fluoranthene	850.0	52.0	800.0	54.0	690.0	55.0	780.0
Pyrene	540.0	52.0	510.0	54.0	440.0	55.0	496.7
Benzo(a)anthracene	140.0	52.0	130.0	54.0	120.0	55.0	130.0
Chrysene	170.0	52.0	170.0	54.0	150.0	55.0	163.3
Benzo(b)fluoranthene	62.0	52.0	61.0	54.0	55.0	55.0	59.3
Benzo(k)fluoranthene	63.0	52.0	64.0	54.0	53.0 J	55.0	60.0
Benzo(a)pyrene	53.0	52.0	52.0 J	54.0	45.0 J	55.0	50.0

<b>TOTAL</b>	5518.0		5247.0		4420.0		5061.7
--------------	--------	--	--------	--	--------	--	--------

Pentachlorophenol	31.0 *	5.2	38.0 *	5.4 *	35.0 *	5.5 *	34.7
-------------------	--------	-----	--------	-------	--------	-------	------

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Denotes that the result is less than the lowest linear standard and is estimated.

\* – Denotes that these values were taken from a different dilution.

AR302493

**TABLE 6 (continued)**  
**RESULTS OF GC/MS CREOSOTE ANALYSIS**

Concentration Reported in mg/Kg

Average Concentration Reported in mg/Kg

**SOUTHERN MARYLAND WOODTREATING SITE**

results based on dry weight of soil

**COMPOST PILE #4 (Day 10)**

September, 1992

<b>Client ID</b>	A17061	A17062	A17063
<b>Extract Dil. Factor</b>	1.0	1.0	1.0
<b>% Solid</b>	84.0	82.0	74.0

LOCATION	LEFT	CENTER	RIGHT	
----------	------	--------	-------	--

COMPOUND NAME	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	Conc. mg/Kg	MDL	AVG. Conc. mg/Kg
---------------	----------------	-----	----------------	-----	----------------	-----	---------------------

Naphthalene	8.3 *	5.8 *	3.7 J *	5.2 *	1.6 J *	5.8 *	4.5
Acenaphthene	300.0	58.0	140.0	52.0	54.0 J	58.0	164.7
Fluorene	220.0	58.0	130.0	52.0	38.0 J	58.0	129.3
Phenanthrene	490.0	58.0	260.0	52.0	98.0	58.0	282.7
Anthracene	860.0	58.0	780.0	52.0	520.0	58.0	720.0
Carbazole	160.0	58.0	99.0	52.0	50.0 J	58.0	103.0
Fluoranthene	510.0	58.0	560.0	52.0	410.0	58.0	493.3
Pyrene	340.0	58.0	380.0	52.0	280.0	58.0	333.3
Benzo(a)anthracene	86.0	58.0	93.0	52.0	74.0	58.0	84.3
Chrysene	120.0	58.0	130.0	52.0	100.0	58.0	116.7
Benzo(b)fluoranthene	46.0 J	58.0	48.0 J	52.0	40.0 J	58.0	44.7
Benzo(k)fluoranthene	45.0 J	58.0	53.0	52.0	37.0 J	58.0	45.0
Benzo(a)pyrene	37.0 J	58.0	41.0 J	52.0	33.0 J	58.0	37.0
<b>TOTAL</b>	3222.3		2717.7		1735.6		2558.5

Pentachlorophenol	18.0 *	5.8 *	21.0 *	5.2 *	16.0 *	5.8 *	18.3
-------------------	--------	-------	--------	-------	--------	-------	------

ND – The compound was analyzed for but not detected at or below the detection limit.

J – Data indicates the presence of a compound that meets the identification criteria.

\* – Denotes that these values were taken from a different dilution.

AR302494

**APPENDIX C**

**Transmittal Memorandum for DNAPL Package**

**Southern Maryland Woodtreating Site**

**Hollywood, MD**

**February 4, 1994**

AR302495



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
ENVIRONMENTAL RESPONSE BRANCH  
Edison, New Jersey 08837

September 27, 1993

MEMORANDUM:

SUBJECT: Southern Maryland Wood Treating - DNAPL Recovery

FROM: Harry L. Allen, Ph.D.  
Environmental Response Team *Harry L. Allen.*

TO: Terry Stilman, OSC  
Lesley Brunker, RPM  
EPA, Region III

As a task during the treatability studies, which were done to support the technology selection process for the Southern Maryland Wood Treating (SMWT) site, the feasibility of recovering the dense nonaqueous phase liquid (DNAPL) creosote oil was also assessed. This memorandum presents the latest information on the DNAPL present at the site and the results of this assessment. Dealing with the DNAPL affects both the removal and remedial aspects of the cleanup, and it is essential that we keep each other informed as we work on this.

It was originally presumed that direct excavation of the DNAPL would be the most practical means of removing it. Subsequent discussions with the Region III hydrogeologist, Cathy Davis, led us to reconsider this strategy. In pursuit of the data needed to explore further this alternative, a sample of the oil was collected for physical and chemical analysis. Visual observation of the sample, plus an evaluation of the chemical composition (Table 1) revealed several important things. First, the oil is nearly pure creosote product, with about 52 percent by weight consisting of identified creosote polynuclear aromatic hydrocarbons (PAHs). Second, the oil has a proportionally higher concentration (21.39%) of Group 3 compounds (4 or more aromatic rings); these are relatively non-biodegradable in solid phase biological treatment systems. This suggests in situ biological treatment of the DNAPL is not feasible and segregation of the DNAPL waste for special handling may be desirable. Finally, the oil is nasty, corrosive and dangerous to work with; pumping and handling may require special equipment and safety precautions. In spite of these difficulties, this DNAPL represents a significant source of soil contamination, sometimes referred to as a "Mother Lode," and it is an element of good site cleanup policy to remove such sources wherever possible.

Design of systems to remove DNAPL from ground water is an emerging field, and there is not much practical experience to draw on. The first step in design is to conduct a hydrogeologic analysis of the aquifer of interest and of the interaction of the



Recycled/Recyclable  
Printed on paper that contains  
at least 75% recycled fiber

AR302496

DNAPL with it. The detailed analysis of this problem is provided in the attached memorandum; standard hydrogeologic methods were used to elucidate the DNAPL migration. Aquifer and contaminant distribution characteristics obtained from the historical site record have been combined with information generated during the current studies in order to develop this analysis. The conclusion of this study is that a simple recovery trench will recharge slowly due to the slow migration rate of 4.8 feet per year, to the extent that in 42 years, only about half of the DNAPL will be recoverable. Use of a companion technology, recovery wells rather than trenches, suffers from the same limitations to the degree that installation of sufficient wells to do the job in a reasonable time would be tantamount to excavation of the entire mass. Thus, excavation appears to be the most expeditious option on the basis of this assessment. The oil is perched on competent clay about 20 feet below the surface and under about 16 feet of ground water. This represents a volume of about 1163 cubic yards for each three feet of depth excavated assuming a 200-foot diameter recovery area. The total volume excavated could be as much as 23,270 cubic yards. Cleaner overburden material may be staged separate from soil containing oil, which will serve to reduce the volume requiring immediate treatment or disposal. However, an oil-water separator capable of dealing with both floating and sinking product will be needed for the pumpage and leachate generated.

Disposal of the recovered oil will have to be investigated. There have been some communications with Allied-Signal Corp., which indicated an interest in recycling the oils. There are, however, limits to what they can take based on the physical and chemical characteristics. A separate memorandum containing the physical properties of the DNAPL sample is also attached to assist in making this determination. Disposal of the oil through Allied will have to be pursued or other alternatives investigated.

I was planning to take off this week, but I am available for consultation at 908-753-1151, or leave me messages at the office 908-321-6747. If necessary, I can also come to the site if you need me.

Attachments

AR302497

TABLE 1 - Composition of Dense Non-aqueous Phase Liquid

Analyte Detected	Concentration (mg/L)	Group 1 Compounds Conc. (mg/L)	Group 2 Compounds Conc. (mg/L)	Group 3 Compounds Conc. (mg/L)
Naphthalene	131,000	131,000		
2-Methylnaphthalene	26,006	26,006		
(Methylnaphthalene)	1,200	1,200		
Acenaphthylene	2,574		2,574	
(Dihydro-acenaphthylene)	10,000		10,000	
Ethyl naphthalene	3,800	3,800		
Dimethylnaphthalene (2)	12,000	12,000		
Acenaphthene	53,500		53,500	
Methylbiphenyl	2,400	2,400		
Dibenzofuran	27,277		27,277	
Methyldibenzofuran	3,600		3,600	
Fluorene	24,661		24,661	
Phenanthrene	89,600		89,600	
Anthracene	8,482		8,482	
Carbazole	3,651		3,651	
Fluoranthene	52,300			52,300
Pyrene*	29,888			29,888
Benz(a)anthracene*	7,061		A2	7,061
Chrysene*	6,533		A2	6,553

AR302498

TABLE 1 - Composition of Dense Non-aqueous Phase Liquid

Benzo(b)fluoranthene*	3,499		A2	3,499
Benzo(k)fluoranthene*	5,438			5,438
Benzo(a)pyrene*	4,057		A2	4,057
unknowns (2)	8,500			
PAH (C15H12)	1,200			
PAH (2) (C17H12)	8,800			
Indeno[1,2,3-cd]pyrene*	<1,980			
Benzo(g,h,i)perylene*	<1,980			
Dibenz(a,h)anthracene*	<1,980			
Benzo(e)pyrene*	(N/A)			
Biphenyl	(N/A)	(N/A)		
2-Methylanthracene	(N/A)			
Anthraquinone	(N/A)			
Benzo(b)fluorene	(N/A)			
TOTAL	527,047	176,406	223,345	108,796
PERCENT COMPOSITION		34.69%	43.92%	21.39%

\* Someone calls these carcinogens  
(These are non-target analytes)

A2 - ACGIH calls these Suspected Human Carcinogens

AR302499



GSA RARITAN DEPOT  
2800 WOODBRIDGE AVENUE  
BLDG. 209 ANNEX  
EDISON, NJ 08837-3879  
908-321-4200 • FAX: 908-494-4021

DATE: September 8, 1993

TO: Harry Allen, U.S. EPA/ERT Work Assignment Manager

THRU: Gary Buchanan, REAC O & A Section Chief  
John Dougherty, REAC Geosciences Group Leader

FROM: Henry He, REAC Hydrogeologist  
Ty Willingham, REAC Geochemist

SUBJECT: Southern Maryland Wood Treating Site - WA# 4-670  
Recommendations: TRENCH / DNAPL LAYER

The Southern Maryland Wood Treating (SMWT) site, located in Hollywood, Maryland was operated as a wood preserving facility from 1965 to 1978. Both creosote and pentachlorophenol (PCP) were known to be used as wood preservatives at the facility. Test results have shown many on-site soil, sediment, groundwater and surface water samples to be contaminated with a variety of hazardous organic compounds. In addition, an oily, dense non-aqueous phase liquid (DNAPL) layer of organic contaminants has been observed by Dames and Moore (1992) in at least five groundwater monitoring wells: MW-11, and MW-28 through MW-31. The DNAPL layer was also observed in these wells and sampled by REAC personnel in 1993. These five wells lie within approximately 150 feet of one another and are located near the center of the containment zone. Several remedial activities have taken place at the site, including the installation of a sheetpile containment wall tied into a basal clay layer by the United States Army Corps of Engineers in 1989-1990.

The U.S. Environmental Protection Agency/Environmental Response Team has proposed the installation of an exploratory recovery trench within the "heart" of the DNAPL plume. The purpose of this trench is to intercept and recover the DNAPL layer, using a bottom lift pump. REAC was requested by the U.S. EPA/ERT to assess and evaluate the effectiveness of this trench.

To evaluate the effectiveness of the proposed trench, REAC developed a conceptual model of subsurface conditions at the site based on the data presented by Dames and Moore (1992). This model has the following characteristics:

- The groundwater table gradient within the containment zone is approximately 1 percent and is oriented south 80 degrees west.
- The hydraulic conductivity of the silty sand aquifer at the site ranges from 0.13 to 4.25 feet/day. The average of the hydraulic conductivity is calculated by REAC to be 1.28 feet/day (slug tests were conducted at seven monitoring wells).
- The DNAPL layer lies atop a clay layer at the base of the uppermost aquifer and is assumed to be circular in shape with a diameter of 200 feet.

DOUGHERTY\M-03

AR302500

- The effective porosity of the site's silty sand aquifer was estimated by REAC at approximately 20 percent (Fetter, 1988).
- The seepage velocity of groundwater was calculated by REAC from Darcy's Law (Fetter, 1988) to be 23 feet/year (which flows south 80 degrees west).
- The specific gravity and viscosity of the DNAPL layer were determined from recent tests completed by REAC to be 1.07 and 3.9 c-stokes, respectively.
- DNAPL conductivity was calculated by REAC to be 0.29 feet/day, (Fetter, 1988).
- The seepage velocity for the DNAPL plume was calculated by REAC to be 5.3 feet/year, according to Darcy's Law.
- The basal clay surface dips at approximately 1.5 percent to the direction south 68.6 degrees east.

The migration direction of DNAPL, with a density higher than water, is governed by both the groundwater table and aquifer base gradients. In the plume area, the dip of the clay layer is 1.5 percent in the direction south 68.6 degrees east. The seepage velocity of DNAPL due to the clay surface gradient was estimated by REAC to be 0.55 feet per year in the direction south 68.6 degrees east. The flow rate of DNAPL due to the hydraulic gradient was estimated by REAC to be 5.3 feet per year in the direction south 80 degrees west. The resultant flow of the DNAPL plume was determined by the addition of these two velocity vectors, which was calculated by REAC to be 4.8 feet per year in the direction south 76.5 degrees west (Figure 1). Additional borings and/or analysis to determine the source area may be required to confirm REAC's conclusion regarding the flow direction of the DNAPL.

Should an exploratory trench be dug at the down-gradient margin of the DNAPL plume, the DNAPL is expected to flow into the trench over a 42 year period. However, only the mobile fraction of the DNAPL plume will be able to flow into the trench. This fraction may represent only 50 percent of the total DNAPL plume, (U.S.EPA, 1991). The residual fraction of the plume, which adheres to the aquifer matrix, will not be recovered by this method.

The exploratory trench will effectively intercept the DNAPL plume's migration ( at 4.8 feet/year). However, due to the characteristics of DNAPL, it is expected that less than 50 percent of the total amount of DNAPL present may be recovered by the trenching method.

**References:**

Dames & Moore. Hazardous Waste Remedial Action Predesign Report, Southern Maryland Wood Preservers Superfund Site, Hollywood, Maryland, Vols. I&II. 1992.

Fetter, C.W. Applied Hydrogeology. New York: MacMillan, 1988.

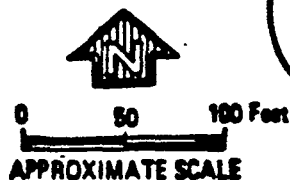
REAC. Preliminary Results of Project - So. Maryland WA #4670, DNAPL, Chain of Custody No. 5974. 1993.

U.S.EPA, Ground Water Issue: Dense Nonaqueous Phase Liquids, EPA/540/4-91--002, March 1991.

cc: Mary Lee Caruso, REAC Task Leader  
Central File, #4-670

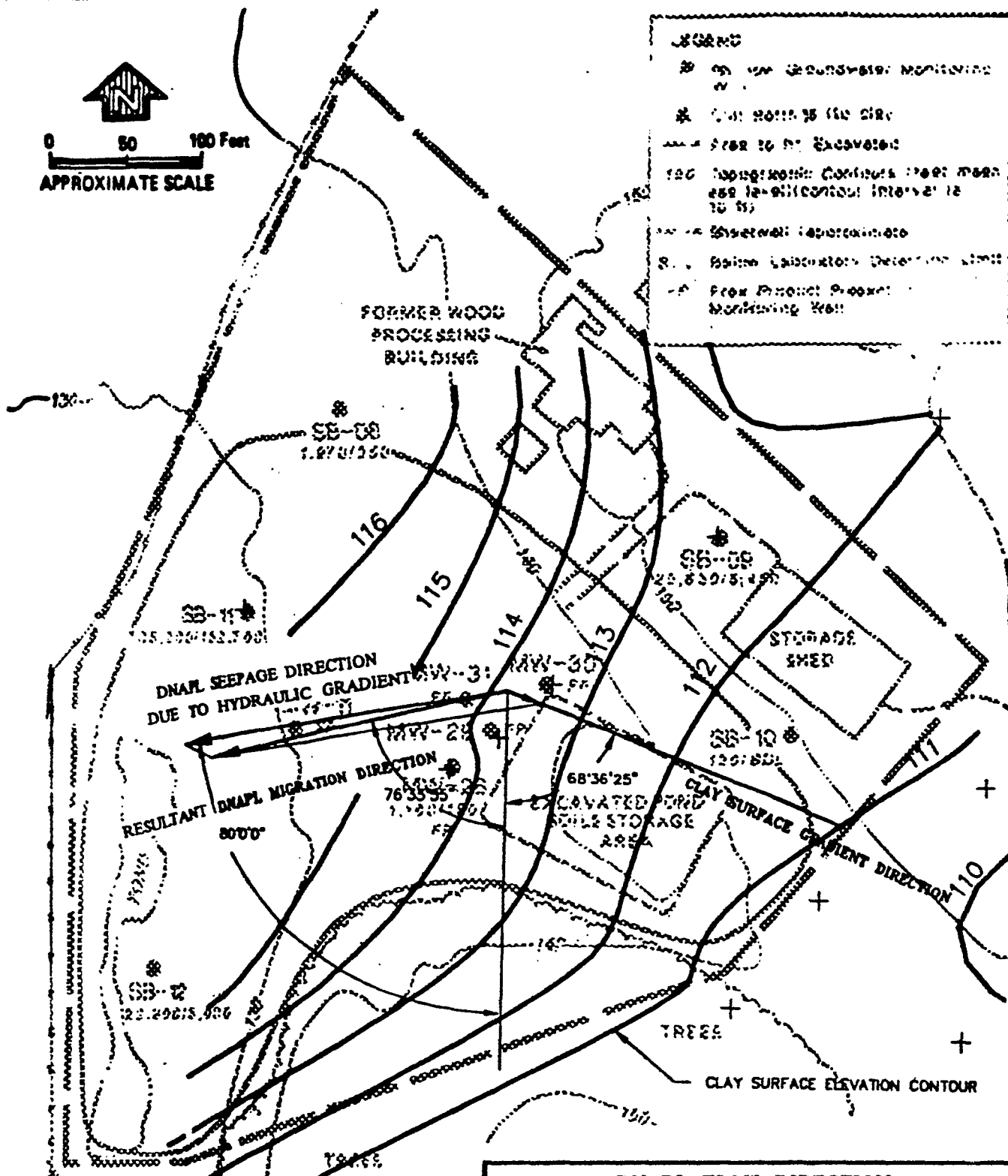
DOUGHERTY\M-03

AR302502



#### LEGEND

- on Groundwater Monitoring
- \* on Monitoring Site
- Area to be Excavated
- 100 Topographic Contours (Feet Mean Sea Level) Contour Interval is 10 ft
- Clay Surface Elevation Contour
- Police Laboratory Detection Limit
- Free Product Product Monitoring Well



#### DNAPL FLOW DIRECTION CLAY SURFACE ELEVATION CONTOURS S. MARYLAND WOOD PRESERVERS SITE HOLLYWOOD, MARYLAND

FIGURE 1

SEPTEMBER 1993

U.S. EPA ENVIRONMENTAL RESPONSE TEAM  
RESPONSE ENGINEERING AND ANALYTICAL CONTRACT

68-03-3482

W.O.# 03347-034-001-5670-01

DNAPL VELOCITY COMPONENTS:  
DUE TO HYDRAULIC GRADIENT = 5.3 ft./year  
DUE TO CLAY SURFACE GRADIENT = .55 ft./year

RESULTANT DNAPL VELOCITY = 4.8 ft./year

AR302503

CLIENT/SUBJECT S. Maryland Wood Preservers W.O. NO. 5670

TASK DESCRIPTION DNAPL / Groundwater Calc. TASK NO. \_\_\_\_\_

PREPARED BY Ty Willingham DEPT O&A DATE 9/1/93

MATH CHECK BY JWO DEPT 106 DATE 9/3/93

METHOD REV. BY \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_

APPROVED BY \_\_\_\_\_

DEPT \_\_\_\_\_ DATE \_\_\_\_\_

I. Calc. of seepage velocity for groundwater: JWO  
9/2/93

Darcy's Law:

$$V = \frac{k_h i}{n}$$

where: <sup>seepage and</sup>  $V$  = velocity in ft./day  
 $k_h$  = hydraulic conductivity in ft./day  
 $i$  = hydraulic gradient in %  
 $n$  = effective porosity in %

known:  $k_h = 1.28$  (ave. from Dames & Moore, 1992)  
 $i = 1\%$  (calc. from Dames & Moore, 1992)  
 $n = 20\%$  (from Fetter, 1988)

so: 
$$V = \frac{1.28 \text{ ft./day} (1\%)}{(20\%)} = \frac{1.28 \frac{\text{ft}}{d} (0.01)}{0.20}$$

$$\therefore V = 0.064 \text{ ft./day}$$

$$= 23.4 \text{ ft./year}$$

CLIENT/SUBJECT S. Maryland Wood Preservers W.O. NO. 5670  
 TASK DESCRIPTION DNAPL / Groundwater Calc. TASK NO. \_\_\_\_\_  
 PREPARED BY Ty Willingham DEPT O+A DATE 9/1/93  
 MATH CHECK BY ASD DEPT EE DATE 9/3/93  
 METHOD REV. BY \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_

APPROVED BY	
DEPT _____	DATE _____

## II. Calc. of intrinsic permeability:

$$K_h = \frac{k \rho g}{\mu}$$

(from Fetter, 1988)

where:  $K_h$  = hydraulic conductivity in cm/sec  
 $\rho$  = H<sub>2</sub>O density @ 25°C in g/cm<sup>3</sup>  
 $k$  = intrinsic permeability in cm<sup>2</sup>  
 $g$  = acceleration of gravity in cm/sec<sup>2</sup>  
 $\mu$  = H<sub>2</sub>O dynamic viscosity in poise

known:  $K_h = 1.28$  (ave. from Dames and Moore, 1992)

$$\text{Now: } \frac{1.28 \text{ ft.}}{\text{day}} \times \frac{12 \text{ in}}{1 \text{ ft.}} \times \frac{2.54 \text{ cm}}{1 \text{ in}} \times \frac{1 \text{ day}}{24 \text{ hr.}} \times \frac{1 \text{ hr.}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} \Rightarrow$$

$$\begin{aligned} K_h &= 4.52 \times 10^{-4} \text{ cm/sec} \\ \rho &= 0.99704 \text{ g/cm}^3 \text{ (from Fetter, 1988)} \\ g &= 980 \text{ cm/sec}^2 \\ \mu &= 0.008937 \text{ poise (from Fetter, 1988)} \end{aligned}$$

$$\text{so: } 4.52 \times 10^{-4} \text{ cm/sec} = \frac{k \times 0.99704 \times 980}{0.008937}$$

$$\therefore k = 4.13 \times 10^{-9} \text{ cm}^2$$

$$k = \frac{\mu K_h}{\rho g} = \frac{4.52 \times 10^{-4} \text{ cm/sec} \times (0.008937 \text{ poise})}{0.99704 \text{ g/cm}^3 \times 980 \text{ cm/sec}^2}$$

CLIENT/SUBJECT <u>S. Maryland Wood Preservers</u>	W.O. NO. <u>5670</u>	
TASK DESCRIPTION <u>DNAPL / Groundwater Calc.</u>	TASK NO. _____	
PREPARED BY <u>Ty. Willingham</u> DEPT <u>O+A</u> DATE <u>9/1/93</u>	APPROVED BY  DEPT _____ DATE _____	
MATH CHECK BY <u>JND</u> DEPT <u>lev</u> DATE <u>9/3/93</u>		
METHOD REV. BY _____ DEPT _____ DATE _____		

### III. Calc. of DNAPL conductivity:

$$K_D = \frac{k \rho g}{\mu} \quad \text{(from Fetter, 1988)}$$

where:

- $K_D$  = DNAPL conductivity in cm/sec
- $\rho$  = DNAPL density in g/cm<sup>3</sup>
- $k$  = intrinsic permeability in cm<sup>2</sup>
- $g$  = acceleration of gravity in cm/sec<sup>2</sup>
- $\mu$  = DNAPL dynamic viscosity in poise

know:

- $k = 4.13 \times 10^{-9} \text{ cm}^2$  (from CALC II)
- $\rho = 1.07 \text{ g/cm}^3$  (from REAC tests)
- $g = 980 \text{ cm/sec}^2$
- $\mu = 3.9 \text{ centistokes}$  (from REAC tests)

$$\text{now: } \frac{3.9 \text{ centistokes}}{1} \times \frac{\text{stroke}}{100 \text{ c-stokes}} \times \frac{1.07 \text{ g}}{\text{cm}^3} \Rightarrow$$

$$\mu = 0.04173 \text{ poise}$$

$$\text{so: } K_D = \frac{4.13 \times 10^{-9} \times 1.07 \times 980}{0.04173}$$

$$\therefore K_D = 1.04 \times 10^{-4} \text{ cm/sec} = 0.29 \text{ ft./day} \quad \text{(see calc. II)}$$

CLIENT/SUBJECT S. Maryland Wood Preservers W.O. NO. 5670

TASK DESCRIPTION DNAPL / Groundwater Calc. TASK NO. \_\_\_\_\_

PREPARED BY Ty Willingham DEPT O & A DATE 9/1/93

MATH CHECK BY JW DEPT bl DATE 9/3/93

METHOD REV. BY \_\_\_\_\_ DEPT \_\_\_\_\_ DATE \_\_\_\_\_

APPROVED BY	
DEPT _____	DATE _____

### IV. Calc. of DNAPL seepage velocity:

Darcy's Law:

$$V = \frac{k_D i}{n}$$

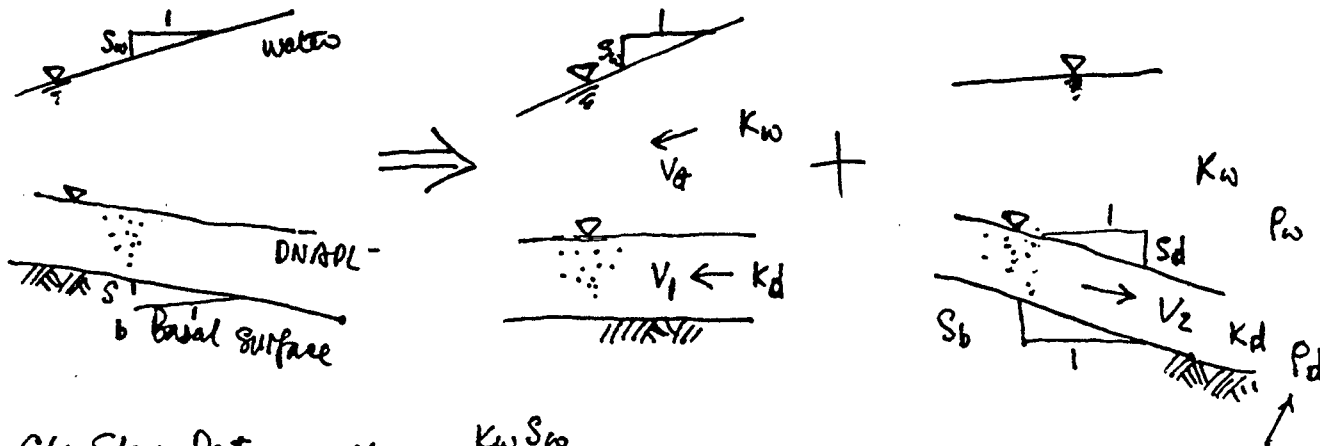
where: *seepage and*  
 $V$  = velocity in ft./day  
 $k_D$  = DNAPL conductivity in ft./day  
 $i$  = hydraulic gradient in %  
 $n$  = effective porosity in %

known:  $k_D = 0.29$  ft./day (see calc. III)  
 $i = 1\%$  (see calc. I)  
 $n = 20\%$  (see calc. I)

$$\text{so: } V = \frac{0.29 \frac{\text{ft}}{\text{day}} \times 1\%}{20\%} = \frac{0.29 \times 0.01}{0.2} \text{ and}$$

$$\therefore V = 0.0145 \text{ ft./day} \\ = 5.3 \text{ ft./year}$$

One dimensional DNAPL flow Analysis:



① G/W Flow Rate:  $V_g = \frac{K_w S_w}{n}$   $n \leftarrow$  porosity

② DNAPL Flow Rate on a flat surface:  $V_1 = \frac{K_d S_w}{n}$

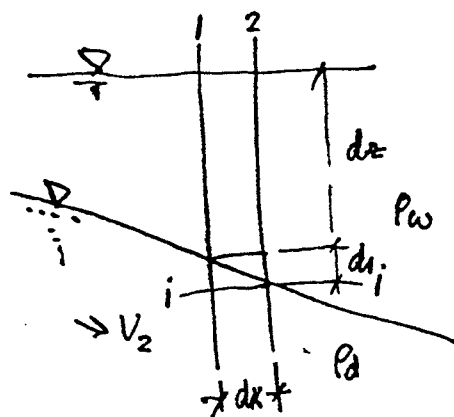
③ DNAPL Flow Rate on a slope, and no Hydraulic Gradient,  $V_2 = \frac{K_d S_d}{n} \cdot \frac{(\rho_d - \rho_w)}{\rho_w}$   
where:  $n$ : porosity,  $\rho$ : density,  $b$ : basal,  $d$ : DNAPL,  $w$ : water.

Analysis of DNAPL flow on a slope <sup>and without</sup> hydraulic gradient:

Assume; continuous release of DNAPL, flow reaches <sup>an</sup> equilibrium condition.

The DNAPL surface, therefore, is parallel to the basal surface,  $S_d = S_b$

Also, assume, Dupite-Farm assumption,



Pressure difference <sup>dp</sup> between 1, and 2 at level  $i-i$

$$\Delta p = p_1 - p_2 = dz \rho_w g + d_i \rho_d g - dz \rho_w g - d_i \rho_w g$$

$$= d_i (\rho_d - \rho_w) g$$

Hydraulic gradient  $S = \frac{\Delta p}{\rho_w g} = \frac{d_i (\rho_d - \rho_w)}{\rho_w dx}$

Since  $S_d = S_b = \frac{d_i}{dx}$  and  $\rho_w = 1$

$$\therefore S = \frac{d_i}{dx} \frac{(\rho_d - 1)}{1} = S_b (\rho_d - 1)$$

Applying Darcy's Law:  $V_2 = \frac{S K_d}{n} = \frac{S_b K_d}{n} (\rho_d - 1)$

**APPENDIX D**

**"Chapter 7 - Incineration Treatability Testing Report"**  
**from the Project Pre-Design Report**

**Southern Maryland Woodtreating Site**  
**Hollywood, MD**

**February 4, 1994**

AR302509

## 7.0 INCINERATION TREATABILITY TESTING REPORT

### 7.1 INTRODUCTION

Onsite incineration was selected by EPA as the remedy of choice for contaminated soils and sediments at the SMWP site in their 1988 ROD. Although incineration has been used in numerous instances to remediate soils contaminated with organic wastes at hazardous waste sites, variations in contaminants, waste types, and incinerator systems make extrapolation of results from one site to another difficult. Even within the bounds of the SMWP site, contaminant profiles vary greatly ranging from slightly contaminated soils to soils saturated in free product. In order to evaluate whether the perceived variability in the waste will impact the incinerator design or operating conditions, a series of samples were collected and tests were run to obtain waste characterization and treatability test data. This data collection and evaluation effort, termed the incineration treatability testing program, includes the following key components:

- Waste characterization tests
- Dewatering tests
- Muffle furnace and ash residual tests

The objectives of this treatability testing program include the following:

- Characterize groups of soils, sediments, and tank contents so that the chemical and physical conditions of the incinerator feed may be predicted and provided for inclusion in bid documents.
- Obtain a perspective on the relationship between the waste characteristics of onsite soils and sediments and the operating conditions needed for successful thermal treatment. This is achieved by conducting muffle furnace tests over a sufficient range of conditions to simulate the time/temperature conditions that are typical of the incinerator systems under consideration for the SMWP site.

- Evaluate whether a combination of site-specific factors (e.g., soil types, soil conditions, and contaminant types) are likely to prevent the desorption of contaminants from the solid waste matrix to the vapor phase, and thereby inhibit the thermal destruction of the organic contaminants.
- Evaluate whether there are advantages to excavating soils in the Containment Area in either horizontal or vertical strips to improve the cost effectiveness of the incineration process by varying operating conditions for groups of soils with varying thermal treatment requirements.
- Evaluate whether thermally treated soils are likely to exhibit the characteristics of a hazardous waste using the Toxicity Characteristic Leaching Procedure (TCLP) criteria.

The treatability studies described in this report will be used in incinerator system evaluations for the SMWP site. The results of the waste characterization, dewatering, and muffle furnace tests will be included in bid specifications to be prepared for submittal to vendors of the candidate incineration systems being considered for use at the SMWP site.

The methods, results, and analysis of the waste characterization tests, dewatering tests, and muffle furnace tests are presented in Sections 7.2, 7.3, and 7.4, respectively. Conclusions derived from each of these tests are discussed in Section 7.5.

## 7.2 WASTE CHARACTERIZATION TESTS

### 7.2.1 Background

Samples were collected from six areas of the SMWP site for the purpose of waste characterization based on the anticipated contamination profile following review of the RI/FS and ROD. The goal of the waste characterization sampling program was to collect samples that are representative of the site waste that will be incinerated. The six site areas where samples were collected to obtain characterization data were

the Upper Site Area, the Northeast Tank Area, the Land Treatment Area and portion of Process Area beyond the containment wall, the Containment Area, the portion of the Spray Irrigation Area beyond the containment wall, and the Streambed of the West Tributary. It should again be emphasized that the samples collected for waste characterization purposes were collected at the same time samples were collected for the contamination assessment (see Section 4.0); thus, the waste characterization samples were selected based on presumed contamination profiles rather than the Section 4.0 data. In addition to the soil and sediment samples discussed above, contaminated liquids, solids, and/or sludges contained in eight of the onsite storage tanks were also sampled for waste characterization purposes. The locations of the onsite tanks are shown in Figure 7-1. Of the six onsite tanks that were not sampled, 3 were empty (T02, T08, T10), one was known to contain water from the RI/FS (T06), and two contained 26 gallons or less of liquid and had previously been characterized during the RI/FS (T13, T14).

The numbers and types of waste characterization samples utilized in this program are summarized in Table 7-1. As shown in Table 7-1, both composite and individual samples were utilized for waste characterization analyses. To reduce the required number of waste characterization analyses, composite samples were utilized to represent those areas where contamination was anticipated to be shallow and the excavation pattern is likely to involve horizontal stripping of soil and/or sediments from each area. Thus, one composite sample was prepared from each of the following areas where excavation and dredging patterns to be followed are predictable: the Upper Site Area, the Northeast Tank Area, the Spray Irrigation Area, and the Streambed. The soil boring/sediment sampling locations from which individual samples were collected to prepare the composite samples are also shown in Table 7-1. In the cases of the Land Treatment Area and the Containment Area, contamination was expected to be relatively deep, and the contamination profile was not expected to be uniform over the excavation depth. Compositing of samples for waste characterization analyses was, therefore, not performed for the Land Treatment Area and the Containment Area, since the resulting data might not be representative of

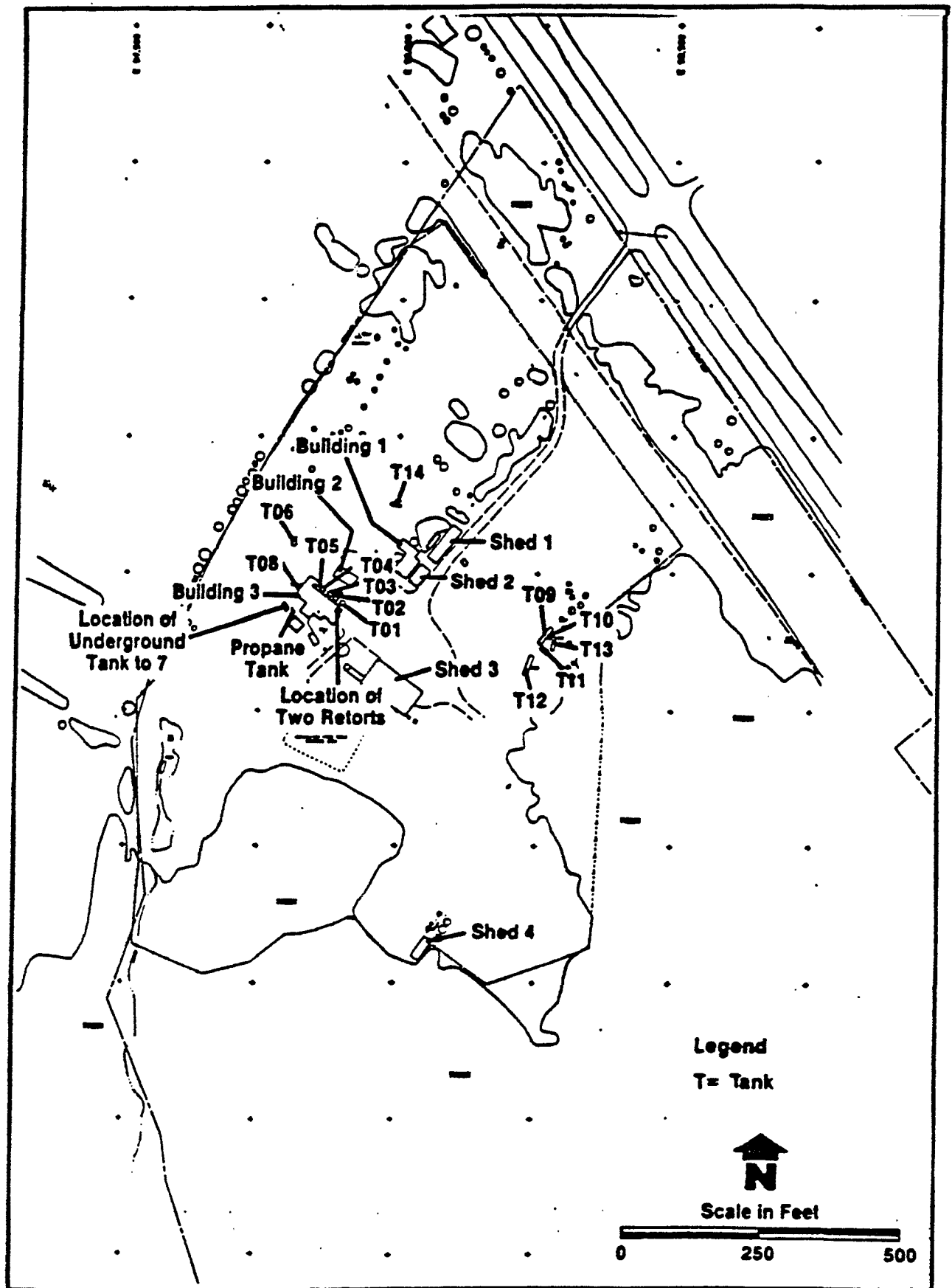


FIGURE 7-1  
Locations of Onsite Tanks

(Source: EPA - RI/FS)

TABLE 7-1

## Summary of Waste Characterization Samples

<u>Site Area</u>	<u>Medium</u>	<u>Depth (feet)</u>	<u>Number/Type of Samples</u>	<u>Soil Boring/Sediment Sampling Locations or Tank Numbers</u>
Upper Site Area	Soil	0 - 1.5	1 Composite	SO02 through SO08
Northeast Tank Area	Soil	0 - 1.5	1 Composite	SO11 through SO15, SO21, SO22
West Tributary Streambed	Sediment	0 - 1.5	1 Composite	SE04, SE05
Spray Irrigation Area	Soil	0 - 1.5	1 Composite	SO26 through SO28
Land Treatment Area	Soil	0 - 2	3 Individual	SB03, SB05, SB06
Land Treatment Area	Soil	10 - 12	3 Individual	SB03, SB05, SB06
Land Treatment Area	Soil	20 - 22	3 Individual	SB03, SB05, SB06
Land Treatment Area	Soil	30 - 32	3 Individual	SB03, SB05, SB06
Containment Area	Soil	0 - 2	5 Individual	MW28, SB08, SB10, SB11, SB12
Containment Area	Soil	10 - 12, 25 - 27	4 Individual, 1 Individual	MW2B, SB08, SB10, SB11 SB10
Containment Area	Soil	Top of clay	5 Individual	MW28, SB08, SB10, SB11, SB12
Tanks	Liquid	NA	5 Individual	T01, T03, T04, T05, T07
Tanks	Solid	NA	3 Individual	T09, T10, T12
Tanks	Sludge	NA	1 Individual	T01

material to be incinerated if assumptions about excavation patterns proved to be incorrect. Individual samples from the Land Treatment Area and the Containment Area were therefore analyzed separately, so that the data can be averaged in such a way as to match the excavation patterns that will actually be employed. As shown in Table 7-1 (Source: EPA - RI/FS), a total of 31 soil and sediment samples and nine tank liquid, solid, and/or sludge samples from the eight tanks were collected for waste characterization.

#### 7.2.2 Laboratory Analyses

The representative samples collected from each area of the site were analyzed to determine the physical and chemical characteristics that could affect the project design and/or cost of incineration. A list of the physical and chemical parameters included in the waste characterization analyses is presented in Table 7-2, along with the analytical methods that were used to determine each parameter.

Each of these parameters is discussed in more detail below:

- Specific Gravity - Used to estimate feed rate and handling requirements.
- Percent Moisture - Used to estimate feed rate, fuel consumption, and feed handling requirements. High moisture contents reduce throughput rates and increase fuel consumption.
- Percent Water - Analysis run on tank liquids to determine whether they are most suitable for incineration or water treatment.
- BTU Content - Used to estimate throughput rate and O&M costs. The highest throughput rates and lowest O&M costs are achieved with low BTU content soils. High BTU soils and sludge feed can cause excessive heat releases causing slagging and solids carryover in a rotary kiln. High BTU liquids that can be used as fuel supplements are of course advantageous to process economics.

TABLE 7-2

## Waste Characterization Methods for Incineration Treatability Tests

<u>Analysis</u>	<u>Soil/Sediments</u>	<u>Tank Sludge</u>	<u>Tank Liquids</u>
Specific Gravity	ASTM D854	ASTM D1429	ASTM D1429
Percent Moisture	EPA 160.3	EPA 160.3	--
Percent Water	--	Karl Fischer	Karl Fischer
BTU Content	ASTM D2015	ASTM D2015	ASTM D2015
Flash Point	EPA 1010	EPA 1010	EPA 1010
Viscosity	--	--	ASTM D2983
Non-Combustible Content	ASTM D2415	ASTM D2415*	ASTM D2415*
Particle Size	ASTM D422	--	--
Dry Weight Chemical Composition			
- Carbon	ASTM D3178	ASTM D3178	ASTM D3178
- Hydrogen	ASTM D3178	ASTM D3178	ASTM D3178
- Oxygen	ASTM E379	ASTM E379	ASTM E379
- Nitrogen	ASTM E147	ASTM E147	ASTM E147
- Sulfur	ASTM D4239	ASTM D4239	ASTM D4239
- Phosphorus	ASTM D4183	ASTM D4183	ASTM D4183
pH	EPA 9045	EPA 9045	EPA 9040
Halogens (Br, F, I, Cl)	EPA 300	EPA 300	EPA 300
TAL Metals	EPA-6010/7000	EPA-6010/7000	EPA-6010/7000
Organic Pollutants (BNA)	EPA-8270	EPA-8270	EPA-8270
Volatile Pollutants (VOC)	EPA-8240	EPA-8240	EPA-8240

\*Was not analyzed in all cases due to safety concerns at laboratory.

- Flash Point - Used to evaluate feed handling requirements.
- Viscosity - Used as one of the parameters to determine whether liquid wastes can be used as burner fuel.
- Non-combustible Content - Used to determine the quantity of ash residual that will remain following incineration.
- Particle Size - Used in estimating moisture content of feed and particulate control requirements.
- Dry Weight Chemical Composition (Carbon, Hydrogen, Nitrogen, and Oxygen) - Used to estimate combustion requirements.
- Phosphorus Content - Used to estimate air pollution control requirements. Organic phosphorus is converted to  $P_2O_5$  during the combustion process, much of which in the form of submicron particulates. These particulates are among the most difficult to scrub and may require sophisticated air pollution control devices to remove.
- Sulfur Content - Used to estimate air pollution control requirements. Sulfur is converted to  $SO_2$  and  $SO_3$  in the combustion process and must be scrubbed out.
- pH - Used to determine handling and equipment maintenance requirements.
- Halogen Content (F, Cl, Br, I) - Used to estimate air pollution control requirements. Chlorine is the principal halogen present. Chlorine is primarily converted to HCl in the combustion process, which must be scrubbed out in the air pollution control system.
- Alkali Metals (Na, K) - Used to evaluate maintenance requirements and air pollution control requirements. Alkali metals are responsible for attacking refractory brick in kilns, which can then be eroded by the

tumbling action of the soil in the kiln. Alkali salts can also volatilize in the kiln and recondense downstream as submicron particles.

- Toxic Metals (As, Cd, Cr, Pb, Hg, Se) - Used to evaluate air pollution control requirements and ash disposal requirements. Individual emission standards for each metal of concern are sometimes set. The toxicity of both the bottom and fly ash as evaluated by the TCLP test is also a consideration.
- Organic Pollutants (VOCs and BNAs) - Used to evaluate air pollution control requirements, ash characteristics, and destruction and removal efficiencies.

### 7.23 Results of Waste Characterization Tests

The waste characterization data obtained as a result of the chemical and physical analyses performed on the samples discussed in Section 7.2.1 are presented in detail in Appendix F, Tables F1 through F15. A summary of these waste characterization data is presented in Table 7-3. The 15 columns of data in Table 7-3 represent the detected averages (i.e., nondetects not included) of individual and/or composited samples collected in a specified horizontal zone or vertical column. Eleven of the columns of data represent either shallow, mid-depth, or deep horizontal zones, and four of the columns of data represent vertical profiles at specified locations within the Containment Area. In reviewing this data, it is important to realize that the boring locations, depth intervals, and compositing schemes were chosen before the results of the contamination assessment were known. In several cases, the waste characterization incorporated samples from areas that are not currently anticipated to be incinerated. Additionally, where information from the contamination assessment could be utilized to expand the waste characterization data base, such information is reflected in data summary of Table 7-3 and is presented in detail in Tables F1 through F15 of Appendix F.

As shown in Table 7-3, VOCs were generally not detected, though they were detected at 125 ppm in the vertically composited sample from boring MW-28 and in

TABLE 7-3

## Summary of Waste Characterization Data

Type of Samples	Sample Locations <sup>1</sup>					
	Upper Site Area	Northeast Tank Area		Process Area and Land Treatment Area		
		Horizontal	Shallow	Shallow	10-12 ft. depth	20-22 ft. depth
				Horizontal	Horizontal	Horizontal
						30-32 ft. depth
<b>Analytes</b>						
• Total VOCs, µg/kg-dry	ND	ND	ND	ND	ND	ND
• Total BNAs, µg/kg-dry	3,080	183	1,325,000	46,800	9,310	5,083
• Metals, mg/kg-dry						
- Aluminum	4,340	4,310	5,713	4,530	3,290	2,964
- Antimony	ND	ND	ND	ND	ND	ND
- Arsenic	1.73	1.75	3.27	6.61	0.98	5.41
- Barium	34.6	22.5	36	13.4	11.47	8.68
- Beryllium	0.472	0.833	1.03	0.93	0.66	1.33
- Cadmium	ND	ND	0.42	ND	ND	ND
- Calcium	442	546	3,047	107.3	69.5	124
- Chromium	6.36	7.1	19.4	18.2	7.15	152
- Cobalt	2.16	2.36	2.57	1.04	0.64	0.78
- Copper	1.56	1.92	10.94	4.17	1.64	2.33
- Iron	6,630	7,440	14,700	18,000	6,743	25,712.33
- Lead	13.3	14.5	18	7.91	7.15	11.8
- Magnesium	322	367	417	196	183	156
- Manganese	54.4	40.4	81.9	8.16	8.04	12
- Mercury	ND	ND	0.14	ND	ND	ND
- Nickel	2.96	2.65	3.55	2.46	2.09	ND
- Potassium	154	157	358	305	308	ND
- Selenium	ND	ND	ND	ND	ND	ND
- Silver	ND	ND	4.14	ND	ND	ND
- Sodium	192	180	22,970	211	220	252
- Thallium	ND	ND	21.7	22.1	ND	39.1
- Vanadium	10.8	11.6	21.9	29.2	12.7	14.6
- Zinc	10.7	9.93	26.7	5.25	5.88	11.7

TABLE 7-3 (cont'd)

Type of Samples	Sample Locations'							
	Containment Area							
	Shallow	Mid-Zone	Deep	Boring SB11	Boring SB10	Boring MW08	Boring MW2	
	Horizontal	Horizontal	Horizontal	Vertical	Vertical	Vertical	Vertical	Vertical
Analytes								
• Total VOCs, µg/kg-dry	ND	ND	125,000	ND	ND	ND	125,000	
• Total BNAs, µg/kg-dry	817,000	121,000	5,217,000	650,000	370	2,740	11,610,000	
• Metals, mg/kg-dry								
- Aluminum	5,718	2,167	1,652	2,002	3,485	3,460	3,870	
- Antimony	ND	ND	ND	ND	ND	ND	ND	
- Arsenic	4.35	1.9	4.69	1.78	3.57	1.68	5.35	
- Barium	23.9	17.4	6.62	15.4	10.2	16.2	29.4	
- Beryllium	0.63	0.43	0.59	0.32	0.27	ND	0.78	
- Cadmium	ND	ND	ND	ND	ND	ND	ND	
- Calcium	196	37.8	82	90.6	67.3	117	122	
- Chromium	7.31	6.14	6.6	6	7.86	4.58	6.96	
- Cobalt	1.99	0.9	1.69	3.32	1.16	3.35	1.16	
- Copper	2.82	3.08	3.8	3.61	2.38	3.21	4.64	
- Iron	10,800	8,450	17,200	6,440	9,670	4,000	22,500	
- Lead	7.7	4.89	6.7	6.7	4.89	ND	7.7	
- Magnesium	313	75.7	56.4	117	131	260	134	
- Manganese	44.2	3.6	15.2	16.3	13.8	33.9	16.5	
- Mercury	ND	0.17	ND	ND	ND	ND	0.17	
- Nickel	3.13	1.49	6.96	6.96	2.03	4.22	2.59	
- Potassium	221	145	188	215	182	183	232	
- Selenium	ND	ND	0.4	0.4	ND	ND	ND	
- Silver	ND	0.59	ND	ND	ND	ND	0.59	
- Sodium	198	175	194	198	189	179	169	
- Thallium	ND	ND	28.5	ND	ND	ND	26.5	
- Vanadium	13.8	11.9	10.6	6.1	15.9	7.75	13.2	
- Zinc	9.09	2.11	5.43	5.59	3.49	7.16	6.31	

AR 202521

TABLE 7-3 (cont'd)

Type of Samples	Sample Locations <sup>1</sup>							
	Containment Area							
	Shallow	Mid-Zone	Deep	Boring SB11	Boring SB10	Boring MW08	Boring MW28	
	Horizontal	Horizontal	Horizontal	Vertical	Vertical	Vertical	Vertical	Vertical
• Dry weight chemical composition, mg/kg-dry								
- Carbon	9,500	773	7,450	4,146	2,000	1,027	14,456	
- Hydrogen	<5,000	<5,000	<5,000	<5,000	<5,000	<5,000	<5,000	
- Nitrogen	308	126	140	292	97	145	328	
- Oxygen	22,620	7,000	10,700	15,700	10,267	13,750	19,250	
- Phosphorous	300	357	345	214	289	176	429	
- Sulphur	227	62.2	166	144	96	86	198	
- Bromide	<1.27	<1.24	<1.25	<1.25	<1.24	<1.15	<1.24	
- Chloride	3.94	3.5	3.37	3.09	2.77	2.64	5.82	
- Fluoride	6.32	5.41	5.52	4.47	5.12	6	7.5	
- Iodide	<6.35	<6.22	<6.27	<6.27	<6.22	<5.69	<6.22	
• Other parameters								
- Btu/lb	<100	<100	<100	<100	<100	<100	<100	
- Flash point, °C	>100	>100	>100	>100	>100	>100	>100	
- Moisture, %	13.3	14.3	16.8	9.7	13.4	10.9	17.6	
- Noncombustible content, %	96.8	99	98.3	98.7	97.9	99.2	97.3	
- pH	5.7	5.8	5.9	5.9	5.8	5.8	5.4	
- Specific gravity	2.68	2.63	2.71	2.58	2.68	2.68	2.69	

TABLE 7-3 (cont'd)

Analytes	Sample Locations <sup>1</sup>		
	Irrigation Area		Streambed
	Horizontal	Shallow	Horizontal Shallow
• Total VOCs, µg/kg-dry	ND	ND	ND
• Total BNAs, µg/kg-dry	1,570	20,260	
• Metals, mg/kg-dry			
- Aluminum	NA	NA	NA
- Antimony	NA	NA	NA
- Arsenic	NA	NA	NA
- Barium	NA	NA	NA
- Beryllium	NA	NA	NA
- Cadmium	NA	NA	NA
- Calcium	NA	NA	NA
- Chromium	NA	NA	NA
- Cobalt	NA	NA	NA
- Copper	NA	NA	NA
- Iron	NA	NA	NA
- Lead	NA	NA	NA
- Magnesium	NA	NA	NA
- Manganese	NA	NA	NA
- Mercury	NA	NA	NA
- Nickel	NA	NA	NA
- Potassium	NA	NA	NA
- Selenium	NA	NA	NA
- Silver	NA	NA	NA
- Sodium	NA	NA	NA
- Thallium	NA	NA	NA
- Vanadium	NA	NA	NA
- Zinc	NA	NA	NA

TABLE 7-3 (cont'd)

Type of Samples	Sample Locations <sup>1</sup>	
	Spray Irrigation Area Horizontal Shallow	Streambed Horizontal Shallow
• Dry weight chemical composition, mg/kg-dry		
- Carbon	6,962	7,400
- Hydrogen	<5,000	4,600
- Nitrogen	374	<5,000
- Oxygen	23,000	<1,000
- Phosphorous	169	<270
- Sulphur	119	4,800
- Bromide	<1.22	<1.64
- Chloride	3.02	5.24
- Fluoride	2.62	3.4
- Iodide	<6.1	<8.19
• Other parameters		
- Btu/lb	<100	<100
- Flash point, °C	<100	>100
- Moisture, %	18	26.3
- Noncombustible content, %	95.6	98
- pH	5.3	6.5
- Specific gravity	2.68	2.69

<sup>1</sup>Average detected values of parameters for samples in each area. Nondetects are not included in the averages.

NA = Not analyzed.

ND = Not detected in any of the samples where the analysis was run in this interval.

the deep layer composite sample from within the Containment Area. Semi-volatile compounds were found throughout the site, with the total concentrations of the compounds varying widely from nondetection to 11,610 ppm. The Containment Area down to the clay layer and the shallow zone in the Land Treatment Area are, by far, the most contaminated locations at the site.

The concentrations of metals at the SMWP site appear to be within the ranges of metals typically observed for soils in the eastern portion of the United States (USGS, 1984).

None of the samples identified in Table 7-3 had measurable heating values (i.e., BTU contents) or flash points below 100°C. Moisture contents ranged from approximately 10 to 18 percent for most samples, except for the streambed, which had an average moisture level of 26 percent.

During the thermal treatment remedial design phase of the project, which overlapped this predesign study, a number of excavation pits were identified on the design drawings. These pits, which were based on pickup standards of 2.2 ppm total cPNAs for surface soil and stream sediments and 10 ppm total cPNAs for subsurface soils, are located in the following areas and encompass the following borings:

<u>Pit No.</u>	<u>Location</u>	<u>Borings Encompassed</u>
1	Containment Area	SB08, SB09, SB10, SB11, SB12, SB16, SB17, SB18, SB19, B4, B5, MW28
2	Land Treatment Area	SB05, SB06, SB07, SB13, SB14, SB15, MW23, MW24, SO32, SO33, SO34, SO35, SO36, SO37, SO38
3	Eastern Tributary	SE01, SE02
4	Northeast Tank Area	SO15, SO17, SOHC-NETA
5	Upper Site Area	SO07, SOHC-UPSA

With more precise information available on the proposed excavation for the thermal treatment design alternative, Table 7-4 was created to present average properties of soils contained within the bounds of the proposed pits. The procedure for calculating

TABLE 7-4  
AVERAGE PROPERTIES OF SOILS AND SEDIMENTS TO BE THERMALLY TREATED

ANALYTES	Pit 1 (Containment Area)			Pit 2a (LTA Shallow)	Pit 2b (LTA Deeper)			Pit 3 Eastern Tributary	Pit 4 NE Tank Area	Pit 5 Upper Site Area	West Tributary (Stream bed)
	0-2 ft.	Inter- mediate Depth	Deepest zone above clay layer	0-2 ft.	5-7 ft.	10-12 ft.	15-17 ft.	0-2 ft.	0-2 ft.	0-2 ft.	0-2 ft.
Total VOCs, ug/kg-dry	BDL	BDL	25,000	BDL	N/A	BDL	N/A	BDL	BDL	BDL	BDL
Total PNAs, ug/kg-dry	629,000	44,000	4,862,000	1,070,000	534,000	71,800	1,351,000	3,680	6,000	3,045	19,200
Total cPNAs, ug/kg-dry	122,000	9,200	571,000	296,000	54,300	26,100	203,300	3,010	5,000	2,650	14,000
Metals, mg/kg-dry											
- Aluminum	5,720	2,170	1,650	7,080	N/A	8,460	N/A	6,370	4,310	4,340	N/A
- Antimony	<4.4	<4.5	<4.5	<4.7	N/A	<4.7	N/A	<4.7	<4.5	<4.4	N/A
- Arsenic	4.4	1.9	3.8	3.3	N/A	11.5	N/A	4.0	1.8	1.7	N/A
- Barium	23.9	17.5	6.6	40.7	N/A	25.7	N/A	28.8	22.5	34.6	N/A
- Beryllium	0.4	0.3	0.5	1.3	N/A	1.4	N/A	0.6	0.8	0.5	N/A
- Cadmium	<0.3	<0.3	<0.4	0.4	N/A	<0.4	N/A	<0.4	<0.3	<0.3	N/A
- Calcium	196	37.8	65.9	4,250	N/A	65.4	N/A	470	546	442	N/A
- Chromium	7.3	6.2	6.6	26.5	N/A	22.2	N/A	12.1	7.1	6.4	N/A
- Cobalt	2.0	0.6	1.7	2.9	N/A	1.3	N/A	2.5	2.4	2.2	N/A
- Copper	2.4	2.1	3.2	15.2	N/A	7.2	N/A	2.9	1.9	1.6	N/A
- Iron	10,800	8,450	17,200	19,600	N/A	31,900	N/A	10,000	7,440	6,630	N/A
- Lead	5.7	<5.3	5.6	22.1	N/A	9.7	N/A	89.0	14.5	13.3	N/A
- Magnesium	313	75.7	56.3	490	N/A	414	N/A	468	367	332	N/A
- Manganese	44.2	3.6	15.2	102	N/A	6.9	N/A	38.2	40.4	54.4	N/A
- Mercury	<0.1	0.1	<0.1	0.2	N/A	<0.1	N/A	<0.1	<0.1	<0.1	N/A
- Nickel	2.5	<1.6	2.7	4.2	N/A	<1.7	N/A	4.1	2.7	2.9	N/A
- Potassium	221	145	163	432	N/A	631	N/A	292	157	154	N/A
- Selenium	<0.2	<0.2	0.2	<0.3	N/A	<0.3	N/A	<0.3	<0.2	<0.2	N/A
- Silver	<0.6	<0.6	<0.6	2.4	N/A	<0.6	N/A	<0.6	<0.6	<0.5	N/A
- Sodium	198	175	194	247	N/A	292	N/A	297	180	192	N/A
- Thallium	<19.4	19.9	23.4	21.3	N/A	22.1	N/A	<20.8	<19.7	<19.3	N/A
- Vanadium	13.8	11.9	10.7	28.6	N/A	46.8	N/A	20.4	11.6	10.8	N/A
- Zinc	9.1	2.1	5.4	35.7	N/A	8.8	N/A	16.8	9.9	10.7	N/A
Dry weight chemical composition, 1g/kg-dry											
- Carbon	9,500	773	7,450	27,900	N/A	1,405	N/A	N/A	3,395	3,310	7,400
- Hydrogen	<5,000	<5,000	<5,000	5,350	N/A	<5,000	N/A	N/A	<5,000	<5,000	4,600
- Nitrogen	308	126	141	648	N/A	107	N/A	N/A	165	259	<5,000
- Oxygen	22,600	5,800	8,440	25,800	N/A	19,600	N/A	N/A	9,600	9,700	<1,000
- Phosphorus	300	302	345	1,040	N/A	335	N/A	N/A	129	137	<270
- Sulphur	227	62	166	305	N/A	32.0	N/A	N/A	51.0	52.0	4,800
- Bromide	<1.2	<1.2	<1.2	<1.2	N/A	<1.2	N/A	N/A	<1.1	<1.1	<1.6
- Chloride	5.4	3.5	3.4	4.2	N/A	6.3	N/A	N/A	2.2	2.3	5.2
- Fluoride	5.9	4.3	5.0	4.3	N/A	7.2	N/A	N/A	10.6	9.6	3.4
- Iodide	<5.8	<5.9	<5.9	<6.1	N/A	<6.1	N/A	N/A	<5.6	<5.7	<8.2
Other parameters											
Btu/lb	<100	<100	<100	<100	N/A	<100	N/A	N/A	<100	<100	<100
- Flash point, oC	>100	>100	>100	>100	N/A	>100	N/A	N/A	>100	>100	>100
- Moisture, %	12.8	15.5	22.7	20.2	13.6	17.3	12.6	N/A	10.7	11.8	26.5
- Noncombustible, content, %	96.3	99.0	98.3	92.1	N/A	97.0	N/A	N/A	98.2	98.4	98.0
pH	5.5	5.8	5.7	6.9	N/A	5.4	N/A	N/A	6.1	6.0	6.5
- Specific gravity	2.7	2.6	2.7	2.7	N/A	2.7	N/A	N/A	2.7	2.7	2.7
Particle size											
Size (% finer by wt)											
# 4	98	100	99	100	N/A	100	N/A	N/A	98	100	100
# 10	97	98	95	99	N/A	100	N/A	N/A	97	99	99
# 60	68	15	21	69	N/A	87	N/A	N/A	80	79	82
# 200	40	5	11	38	N/A	46	N/A	N/A	48	47	64
Hydrometer											
% Sand	60	93	88	69	N/A	54	N/A	N/A	52	53	36
% Silt	24	2	5	14	N/A	18	N/A	N/A	31	28	34
% Clay	16	5	7	17	N/A	28	N/A	N/A	17	19	30

es: BDL - Below Detection Limit  
N/A - Not analyzed

the averages presented in Table 7-4 differs from the procedure used to calculate the averages in Table 7-3. The values presented in Table 7-4 include nondetect values for parameters (figured as zeros) in calculating the averages, while Table 7-3 only includes values in which the parameter was detected.

The characterization data from the tanks sampling are presented in Table 7-5. The results from each tank are presented individually, as these results are not amenable to averaging.

### 7.3 DEWATERING TESTS

#### 7.3.1 Background

The moisture levels of wastes that are incinerated have an important effect on the treatment costs. High moisture levels typically result in reduced waste throughput, increased fuel requirements, and consequently increased costs. Some of the contaminated soils and sediments at the SMWP site that will be excavated and treated will contain free liquids that should be removed prior to incineration. These soils and sediments may include waste materials excavated from the saturated zone and the stream bed of the West Tributary. While the saturated zones within the Containment Area and Land Treatment Area will be dewatered during the excavation of these areas, some of the excavated soil will probably contain free liquid. The excavated sediments from the streambed will also contain free liquid.

All excavated soils and sediments will be stored in stockpiles prior to incineration. Wet materials will be stored in stockpiles designed to facilitate gravity draining and collection of the free liquids. To increase the reliability of the cost estimates to be developed by incinerator vendors who submit bids for this project, the post-dewatering moisture levels have been estimated for inclusion in the bid specifications. The methods employed to estimate the moisture levels that will be present in soils and sediments after these materials are excavated and dewatered, and the results of these dewatering tests, are presented in the following subsections.

TABLE 7-5

SUMMARY OF TANK CHARACTERISTICS

Sample ID's	101-SLUDGE	101-LIQUID	101-LIQUID D	103-LIQUID	104-LIQUID	105-LIQUID	107-LIQUID	109-SOLID
VOLATILE ORGANIC COMPOUNDS DETECTED								
UG/KG-DRY								
ACETONE	--	--	--	--	--	240.00	--	--
BENZENE	11,000.00	15.00	45.00	--	--	--	--	--
ETHYLBENZENE	20,000.00	17.00	28.00	--	--	--	9.20	--
METHYL ETHYL KETONE	--	--	--	5,600.00	7,000.00	9.30	9.90	--
STYRENE	26,000.00	19.00	35.00	--	--	93.00	--	--
TOLUENE	39,000.00	34.00	81.00	--	--	--	--	--
XYLENE	73,000.00	59.00	100.00	--	--	--	26.00	--
Total VOCs	169,000.00	144.00	289.00	53,000.00	61,000.00	79.00	61.00	12,000.00
				58,600.00	68,000.00	421.30	106.10	12,000.00
BASE NEUTRAL AND ACID EXTRACTABLE COMPOUNDS DETECTED								
UG/KG-DRY								
2,4-DIMETHYLPHENOL	--	--	--	--	--	--	560.00	--
2-METHYLNAPHTHALENE	2,000,000.00	20,700.00	2,310,000.00	5,730,000.00	2,280.00	--	88.20	3,000,000.00
2-METHYLPHENOL	--	3,310.00	--	--	--	--	1,280.00	--
4-METHYLPHENOL	--	7,660.00	385,000.00	--	--	--	2,450.00	--
ACENAPHTHENE	3,800,000.00	59,000.00	5,200,000.00	--	--	--	--	--
ANTHRACENE	3,400,000.00	12,000.00	1,400,000.00	--	--	--	--	1,200,000.00
BENZO(A)ANTHRACENE	6,100,000.00	9,600.00	790,000.00	--	--	--	--	--
BENZO(A)PYRENE	--	3,200.00	260,000.00	--	--	--	--	--
BENZO(B)FLUORANTHENE	2,000,000.00	4,300.00	380,000.00	--	--	--	--	--
BENZO(K)FLUORANTHENE	2,200,000.00	--	160,000.00	--	--	--	--	--
CHRYSENE	6,500,000.00	7,500.00	670,000.00	--	--	--	--	--
DIBENZOFURAN	2,700,000.00	34,900.00	3,250,000.00	--	--	--	--	--
FLUORANTHENE	4,200,000.00	82,000.00	6,100,000.00	--	--	--	--	--
FLUORENE	4,000,000.00	37,000.00	3,400,000.00	430,000.00	--	--	12.00	1,200,000.00
NAPHTHALENE	7,000,000.00	97,000.00	6,800,000.00	1,200,000.00	--	--	--	880,000.00
PENTACHLOROPHENOL	--	--	--	4,200,000.00	640.00	--	120.00	--
PHENANTHRENE	1,100,000.00	120,000.00	9,700,000.00	760,000.00	16,000.00	910,000.00	--	1,600,000.00
PHENOL	--	15,000.00	320,000.00	--	270.00	89,000.00	16.00	2,500,000.00
PYRENE	3,200,000.00	38,000.00	3,300,000.00	--	5,800.00	--	--	--
Total BNAs	429,800,000.00	551,170.00	44,425,000.00	50,120,000.00	24,990.00	999,000.00	4,537.20	1,300,000.00
								170,080,000.00

TABLE 7-5

SUMMARY OF TANK CHARACTERISTICS

Sample ID's	T01-SLUDGE	T01-LIQUID	T01-LIQUID D	T03-LIQUID	T04-LIQUID	T05-LIQUID	T07-LIQUID	T09-SOLID
<b>TARGET ANALYTE LIST METALS</b>								
ALUMINUM	14.70	500.00	500.00	10.00	3,600.00	3,800.00	387.00	1,700.00
ANTIMONY	8.70	500.00	500.00	10.00	80.00	50.00	50.00	9.50
ARSENIC	251.00	100.00	100.00	2.00	2.60	10.00	10.00	8.98
BARIUM	1.13	100.00	100.00	2.00	176.00	48.90	73.30	491.00
BERYLLIUM	0.28	50.00	50.00	1.00	5.10	5.00	5.00	5.84
CADMIUM	0.66	130.00	69.90	1.00	6.00	47.50	17.20	0.71
CALCIUM	106.00	35,300.00	40,200.00	39.90	9,460.00	7,150.00	22,400.00	437.00
CHROMIUM	1.25	100.00	100.00	2.00	11.40	10.00	10.00	23.30
COBALT	0.22	100.00	100.00	2.00	20.00	13.00	10.00	5.57
COPPER	2.43	117.00	106.00	2.00	67.50	107.00	11.70	140.00
IRON	2,650.00	854,000.00	387,000.00	21.30	69,400.00	91,000.00	59,600.00	69,500.00
LEAD	10.30	213.00	109.00	1.75	16.90	732.00	39.20	186.00
MAGNESIUM	30.70	10,600.00	12,600.00	10.00	2,590.00	1,620.00	19,200.00	358.00
MANGANESE	13.30	4,730.00	4,490.00	2.00	460.00	655.00	478.00	206.00
MERCURY	0.93	13.60	28.60	0.10	40.00	3.57	1.63	9.62
NICKEL	3.06	41,600.00	49,100.00	4.00	250.00	3,440.00	23,000.00	14.00
POTASSIUM	125.00	50.00	50.00	100.00	1,690.00	5.00	5.00	136.00
SELENIUM	222.00	212.00	100.00	2.00	2.10	5.00	5.00	0.49
SILVER	1.07	70,200.00	81,400.00	58.70	9.80	24.30	16.00	1.16
SODIUM	397.00	100.00	100.00	2.00	5,640.00	8,350.00	1,150,000.00	431.00
THALLIUM	172.00	100.00	100.00	2.00	5.40	10.00	10.00	41.80
VANADIUM	1.18	100.00	100.00	2.00	10.80	18.80	109.00	8.15
ZINC	6.48	2,260.00	1,960.00	2.00	1,040.00	39,400.00	15.50	144.00
<b>DRY WEIGHT CHEMICAL COMPOSITION</b>								
CARBON	5,000.00	5,000.00	5,000.00	830,100.00	791,400.00	831,900.00	11,400.00	674,900.00
HYDROGEN	109,500.00	106,800.00	104,900.00	120,500.00	114,200.00	126,900.00	100,900.00	82,300.00
NITROGEN	5,000.00	5,000.00	5,000.00	5,000.00	6,200.00	5,000.00	5,000.00	5,000.00
OXYGEN	387,100.00	884,900.00	882,200.00	37,700.00	10,900.00	28,500.00	885,600.00	99,500.00
PHOSPHORUS	140.00	330.00	250.00	340.00	160.00	320.00	370.00	350.00
SULFUR	3,000.00	80.00	80.00	2,200.00	2,800.00	82.00	80.00	3,000.00

TABLE 7-5  
SUMMARY OF TANK CHARACTERISTICS

Sample ID's	T01-SLUDGE	T01-LIQUID	T01-LIQUID D	T03-LIQUID	T04-LIQUID	T05-LIQUID	T07-LIQUID	T09-SOLID
HALOGEN CONTENT MG/KG-DRY								
BROMIDE	<	1.00 <	1.00 <	1.69 <	2.54 <	1.97	4.34 <	2.40
CHLORIDE		156.70	153.50	22.39	14.45	8.38	1,254.00	46.10
FLUORIDE	<	22.70	18.00 <	3.37 <	5.08 <	3.94 <	1.00	12.60
IODIDE	<	10.00 <	10.00 <	8.40 <	12.70 <	9.90 <	5.00 <	12.00
OTHER PARAMETERS								
BTU	7,010.00	100.00	1,730.00	18,700.00	18,600.00	1,950.00	100.00	9,220.00
FLASH POINT DEG-C	>	100.00 >	100.00	57.00	75.00 >	100.00 >	100.00 >	100.00
MOISTURE	58.30	--	--	--	--	--	--	58.30
NON COMBUSTIBLE CONTENT	NA	NA	NA	NA	NA	NA	NA	NA
PH	--	6.21	6.73	4.12	--	6.32	6.59	5.00
STD. UNITS	--	1.02	0.99	0.88	1.32	0.99	1.09	--
SPECIFIC GRAVITY	--	0.74	11.70	2.93	--	0.77	0.69	--
VISCOSITY CST	--	93.66	99.06	0.24	--	0.47	92.35	--
KARL FISCHER WATER	93.52							0.32

AR302530

### TABLE 7-5

**VOLATILE ORGANIC COMPOUNDS DETECTED**

**TABLE 7-5**  
SUMMARY OF TANK CHARACTERISTICS

Sample ID's	:	T10-SOLID	T12-SOLID
<b>TARGET ANALYTE LIST METALS</b>			
ALUMINUM		394.00	174.00
ANTIMONY		6.30	6.10
ARSENIC		19.20	5.73
BARUM		10.50	18.50
BERYLLIUM		1.48	0.78
CADMIUM		3.27	0.85
CALCIUM		493.00	924.00
CHROMIUM		7.08	3.70
COBALT		0.48	0.97
COPPER		22.60	25.40
IRON		16,400.00	7,000.00
LEAD		123.00	24.60
MAGNESIUM		125.00	241.00
MANGANESE		65.90	68.80
MERCURY		3.62	0.71
NICKEL		8.41	2.92
POTASSIUM		89.80	410.00
SELENIUM		1.72	1.35
SILVER		0.77	0.75
SODIUM		647.00	1,130.00
THALLIUM		27.60	26.90
Vanadium		3.47	0.83
ZINC		234.00	41.40
<b>33 DRY WEIGHT CHEMICAL COMPOSITION</b>			
CARBON		905,500.00	855,200.00
HYDROGEN		45,900.00	65,800.00
NITROGEN		12,500.00	7,000.00
OKYGEN		38,100.00	21,900.00
PHOSPHORUS		400.00	320.00
SULFUR		4,500.00	5,700.00

### TABLE 7-5

R 302533

### **7.3.2 Methodology of Dewaterability Evaluation**

In addition to the waste characterization analyses described in Section 7.2, additional physical properties data was required to estimate the residual levels of moisture that will be retained in the excavated soils and sediments after stockpiling and gravity draining to remove free liquids. The physical properties required to estimate the moisture content of presently saturated soils and sediments after excavation and gravity draining are listed below, together with the test methods employed for measuring these properties:

1. Moisture content (EPA 160.3)
2. Grain size distribution (for granular soils) (ASTM D422)
3. Atterberg Limits (for cohesive soils) (ASTM D4318)
4. Minimum index (loose) density of soils (for granular soils) (ASTM D4254)
5. Specific gravity (ASTM D854)

The physical property data collected in this program for use in the moisture analyses are presented in Table 7-5. These measured physical property data were used to predict the moisture levels of the dewatered soils and sediments, based on typical data for soils and sediments with similar properties. The estimates of moisture content were based on the above numbered physical properties 1, 2, 4, and 5 for granular soils, and on physical properties 1, 3, and 5 for cohesive soils.

Granular soils (sands) can be evaluated for their moisture content at saturation based on a "zero air voids" analysis. Specifically, the moisture content at saturation represents the percentage of moisture required to fill the void space in a given volume. Based on the physical property data in Table 7-6 the granular soils to be excavated are estimated to have a saturated moisture content varying between 12 percent and 18 percent. "Zero air voids" represent the complete saturation of soil at a given dry density, which indicates the point where any additional moisture should

TABLE 7-6  
SOIL LAB DATA SUMMARY

ESE Sample ID	D&M Sample ID	Specific Gravity	PARTICLE SIZE ANALYSIS						ATTENUATION LIMITS				Minimum Index Density (pcf)	
			Sand (% Finer by Wt)						Hydrometer					
			#4	#10	#60	#200	%SAND	%SILT	%CLAY	Liquid Limit	Plastic Limit	Plasticity Index		
SMWPS1*181	UPPER SITE AREA													
	SOHC-UPSA	2.67	100	99	79	47	53	28	19				19	
SMWPS1*182	NORTHEAST TANK AREA													
	SOHC-NETA	2.68	98	97	80	48	52	31	17				12	
SMWPS1*184	PROCESS AREA (Uncontaminated) AND LAND TREATMENT AREA													
	SB03-0002	2.67	100	100	75	43	57	28	17				11	
	SB03-1012	2.73	100	100	51	17	83	6	11				10	
	SB03-2022	2.68	100	99	16	3	97	2	1				22	
	SB03-3001	2.70	99	97	31	12	88	7	5				23	
	SBVC-SB03	2.69	100	99	28	11	89	6	5				23	
	SB05-0002	2.65	96	95	66	26	74	18	8				26	
	SB05-1012	2.68	100	99	31	10	90	4	6				12	
	SB05-2022	2.68	100	99	20	5	95	4	1				17	
	SB05-3101	2.70	100	98	40	30	70	20	10				24	
	SBVC-SB05	2.68	100	99	30	10	91	3	6				21	
	SB06-0002	2.61	99	97	63	31	69	14	17				23	
	SB06-1012	2.71	100	100	87	46	54	18	28				19	
	SB06-2022	2.70	99	97	45	19	81	8	11				24	
	SB06-3101	2.70	96	94	27	14	86	5	9				20	
	SBVC-SB06	2.72	100	99	38	16	84	6	11	24	14	10	22	
SMWPS1*211	CONTAMINANT AREA													
	SB08-0002	2.70	100	100	84	64	36	32	32				19	
	SB08-1012	2.67	100	99	23	9	91	1	8				20	
	SB08-2001	2.67	99	96	12	5	96	3	2				15	
	SBVC-SB08	2.71	100	99	27	9	91	3	6				18	
	SB10-0002	2.68	100	100	69	33	67	19	14				13	
	SB10-1012	2.67	100	100	40	5	95	1	4				4	
	SB10-2027	2.69	99	96	36	12	88	7	5				26	
	SB10-3101	2.69	100	97	22	8	94	2	4				23	
	SBVC-SB10	2.70	100	99	34	13	87	4	9				13	
	SB11-0002	2.61	99	97	75	47	53	36	12				23	
	SB11-1012	2.43	100	96	12	6	94	4	2				17	
	SB11-01	2.70	96	95	26	12	88	6	6				22	
	SBVC-SB11	2.68	100	96	27	14	86	8	6				14	
	SB12-0204	2.73	96	94	49	26	74	17	8				21	
	SB12-01	2.72	100	97	23	12	88	6	5				17	
SMWPS1*234	SBVC-SB12	2.70	100	96	27	15	85	7	7			NP	19	
	MW28-0002	2.67	97	96	61	29	71	14	15			NP	19	
	MW28-1012	2.68	100	96	20	3	93	3	4			NP	19	
	MW28-01	2.72	96	87	39	28	72	10	18			NP	18	
	SMWPS1*237	2.72	96	87	39	28	72	10	18			NP	18	
	SMWPS1*238	2.66	96	93	29	8	92	2	6			NP	18	

# AB 7-6 (cont'd) SOIL LAB DATA SUMMARY

ESE Sample ID	DLM Sample ID	PARTICLE SIZE ANALYSIS						ATTENBURG LIMITS					Minimum Index Density (pcf)		
		Specific Gravity	Sand (% Finer by Wt)				Hydrometer	Liquid Limit	Plastic Limit	Plasticity Index	Moisture Content (%)				
			#4	#10	#60	#200						%SAND		%SILT	%CLAY
SPRAY IRRIGATION AREA (Uncontaminated)															
SMWPS1*183				100	88	72	28	43	29			21			
SMWPS1*239				100	100	89	74	26	26			22			
				100	100			46							
STREAM BED															
SMWPD1*8				100	99	82	64	36	34	30	62	17	48		
SEHC-STFM															

\*Air-dried

\*\*Not enough material for representative sampling

NP=Plastic

Source: ESE, 1991.

Specific Gravity performed according to ASTM D 854, Particle Size performed according to ASTM D 422.

Minimum Index Density performed according to ASTM D 4254, Atterberg Limit performed according to ASTM D 4318

be freely draining. The "zero air voids" density for any moisture content may be calculated from the following formula:

$$W_{\text{max}} = \left( \frac{\gamma_w}{\gamma_d} - \frac{1}{G_s} \right) \quad (\text{Eq 1})$$

where,

$W_{\text{max}}$  = Moisture Content at Saturation Stage (%)

$\gamma_d$  = Dry Density of Soil (PCF)

$\gamma_w$  = Unit Weight of Water at 62.4 PCF

$G_s$  = Specific Gravity of Soil

Any moisture in excess of this range is considered free moisture that should drain during in-place dewatering for excavation and post dewatering from stockpiling. This evaluation applies to granular soils to be excavated at or below the groundwater table in the saturated zone.

Cohesive soils (silts and clays) will generally remain unaffected by in-place or gravity drainage during stockpiling. Moisture contents for these soils will depend upon physical characteristics such as liquid limit and plastic index defined by Atterberg Limits testing.

### 7.3.3 Results of Dewatering Tests

In-place dewatering and excavation methods will need to be considered before removal of contaminated soils can proceed below the level of the groundwater table. An effective dewatering and excavation program should result in the in-place moisture content of granular soils to be lowered below 20 percent by removal of free liquid. A transition zone of cohesive soils is anticipated at the base of the planned excavations, and higher moisture contents that remain relatively unaffected by in-place dewatering should be anticipated there. Table 7-7 presents the estimated in-place and

TABLE 7-7

## Estimated Quantities and Moisture Conditions in Proposed Areas of Excavation

<u>Location</u>	<u>Associated Borings</u>	<u>Soil Conditions</u>	<u>Estimated In-place Moisture</u>	<u>Depth Range</u>	<u>Estimated Volume of Excavation*</u>	<u>Estimated Moisture After Gravity Drainir</u>
Containment Area (Pit 1)	SB-8 to SB-12	Sands, silty sands, and clayey sands (SW, SP, SM, SC)	4% to 23% (average 15%)	From ground surface to depths of 4 ft to 25 ft (above groundwater)	79,400± cu yd total saturated and unsaturated soils	4% to 23% (average 15%)
		Sands, silty sands, and clayey sands (SW, SP, SM, SC)	17% to 25% (average 20%)	Below groundwater at depths of 4 ft to 25 ft down to basal clay layer at 10 ft to 40 ft	64,500± cu yd	12% to 18% (average 15%)
Land Treatment Area (Pit 2)	SB-2 to SB-7	Sands and silty sands (SW, SP, SM)	10% to 26% (average 17%)	From ground surface to depths of 18 ft to 26 ft (above groundwater)	31,900± cu yd	10% to 26% (average 17%) <sup>1</sup>
Northeast Tank Area/Process Area/Upper Site Area (Pits 3, 4, and 5)	SB-1 and SO-1 to SO-22	Sands, clays, and silts (SW, SP, SM, SC, CL, ML, and MH)	12% to 19% (average 16%)	From ground surface to depths of 4 ft to 12 ft (associated borings were shallow and above groundwater)	4,700± cu yd	12% to 19% (average 16%) <sup>1</sup>

TABLE 7-7 (cont'd)

## Estimated Quantities and Moisture Conditions in Proposed Areas of Excavation

Location	Associated Borings	Soil Conditions	Estimated In-place Moisture	Depth Range	Estimated Volume of Excavation*	Estimated Moisture After Gravity Draining
Spray Irrigation Area	SO-26 to SO-28	Sands and silty sands	Average 21%	From ground surface to depth of 4.5 ft (associated borings were shallow and above groundwater)	0 cu yd	12% to 18% (average 15%)**
West Tributary Streambed	SE-4 and SE-5	Stream sediments	Average 48%	Near surface	1,500± cu yd	40% to 50%**

\* Minimum effect due to gravity draining.

• This table is based upon a limited number of test borings with accompanying laboratory testing. Excavation volumes include the overexcavation of clean soils required to remove contaminated soils. Subsoil conditions between borings may vary and should be field-verified prior to and during excavation.

\*\*Based on engineering judgement. No laboratory data are available.

post-dewatering moisture contents for contaminated soils to be excavated, as well as anticipated volumes.

Effective mixing of contaminated soils removed from above and below the saturated zone would provide a composite profile that gives an intermediate moisture content. The physical property data indicate that a composite profile generated by mixing can generate moisture contents averaging about 17 percent. Table 7-7 indicates that the larger volume of contaminated soils for removal occur above the saturated zone, which gives a larger proportion of material at lower moisture contents available for mixing.

Excavated soils placed in stockpiles will generally not drain effectively other than at surfaces exposed to air. Seasonal conditions will also affect soils placed in stockpiles. Wet soils that are stockpiled without intermixing with dry soils should be segregated, where possible, between sands collected from the upper granular stratum and clays/silts collected from the lower transitions zone. Organic soils that are encountered should be stockpiled with the clays/silts. Separation will facilitate drying of the granular soils, which are better draining materials. The clays and silts will generally retain their in-situ moisture contents.

Stockpiled soils should be installed over pads that incorporate drains to accumulate and dissipate runoff. Protective covering such as polyethylene sheeting should be considered for stockpiles not in active use to prevent wetting from prevailing weather conditions, although this covering will in effect prevent surface drying of wet stockpiled soils. Roofing the drainage pads may be an attractive option.

A combination of intermixing and stockpiling of soils is anticipated to be used at the site, depending on weather, excavation/dewatering procedures, and space restrictions. The evaluation provided herein is based on a limited number of test borings, and subsoil conditions may vary between these locations. It is recommended that the moisture and physical properties of the contaminated soils be monitored and evaluated during the excavation.

## 7.4 MUFFLE FURNACE TESTS

### 7.4.1 Background

A muffle furnace consists of a small well-insulated oven in which samples of waste can be heated in a static environment under closely controlled conditions. The tests can be carried out over a range of temperatures and residence times to simulate conditions in the types of incinerators under consideration. Due to the small size and design of the furnace, oven heat-up rates are relatively fast and the desired test temperatures can be rapidly achieved. The results of the muffle furnace tests can be useful for determining optimum incinerator operating conditions and in assessing whether the resulting ash residues will be hazardous or non-hazardous.

The principal limitation of a muffle furnace is the inability of the test to simulate the dynamic conditions inside a full-scale incinerator. While the muffle furnace can simulate temperature and residence time conditions in a full-scale system, it cannot simulate the mixing and turbulence that occur in most incineration systems. In addition, because muffle furnaces are generally sealed, or the oven doors are left slightly ajar, the furnaces cannot accurately simulate the combustion that occurs in a full-scale incinerator. In spite of these limitations, muffle furnaces can provide useful information about the waste such as the expected volume and weight reduction upon incineration, the tendency for the waste to agglomerate at various temperatures, and the physical and chemical properties of the ash residues.

A subset of the 31 waste characterization samples listed in Table 7-1 were composited for use in the muffle furnace tests. A total of 14 composite samples were collected for use in the muffle furnace tests. Compositing was performed to reduce the number of treatability tests to a manageable number, so that the tests could be completed in a reasonable time frame and at a reasonable cost. Samples were composited on a vertical and/or horizontal basis, depending on the potential methods available for excavating each of the contaminated areas at the site. A vertically composited sample is a sample created from soils collected from a single boring encompassing multiple depth intervals. A horizontally composited sample is a sample

created from soils collected from multiple borings at the same depth interval. Based on the existing site characterization data and the waste characterization sampling program described in Section 7.2, the following compositing scheme was employed for the muffle furnace tests:

- Upper Site Area and Northeast Tank Area - A single composite sample designed to represent both areas was prepared, consisting of soil from borings SO2 through SO8, SO11 through SO15, and SO21 through SO22.
- Process Area (Uncontained) and Land Treatment Area - Three composite samples were prepared to represent three different depth horizons. Soils collected from borings SB03, SB05, and SB06 were composited in such a way as to represent the depth intervals of 0 to 5 feet, 5 to 10 feet, and 10 to 20 feet, respectively.
- Containment Area - Eight composite samples were prepared to represent this area, which is known to be contaminated down to the underlying clay layer. Five of the composite samples were collected vertically in single borings from the surface down to the clay layer. The borings selected for vertical compositing were SB08, SB10, SB11, MW28, and SB12. Three of the composite samples were prepared by horizontally compositing samples collected at the same depth intervals from these same five borings, with soil being composited to represent shallow (0 to 5 feet), mid-zone (10 to 15 feet), and deep (along the clay layer) intervals. This combination of vertical and horizontal composite samples should be representative of the soil to be incinerated, whether excavation is performed vertically over several separate subdivided areas or horizontally over the entire acreage of the Containment Area.
- Spray Irrigation Area - One composite sample was prepared from shallow soils collected at borings SO26 through SO28.
- Streambed - One composite sample was prepared consisting of sediment samples collected from locations SE04 and SE05.

The tank solids, sludges, and liquids present in former process tanks at the SMWP site were not included in the muffle furnace tests, due to the uncertainty in the preferred treatment/disposal method for these wastes and the unsuitability of running muffle furnace tests on highly combustible materials.

#### 7.4.2 Methodology of Muffle Furnace Tests

The muffle furnace tests were performed by Ogden Environmental Services. A detailed description of the muffle furnace tests and the protocol employed in conducting the tests are presented in Appendix F, which includes the Muffle Furnace Test Report prepared by Ogden Environmental Services. A brief summary of the equipment and procedures employed in the muffle furnace tests is provided in the following paragraphs.

Equipment employed for the muffle furnace tests included a Thermolyne Type 6000 Muffle Furnace, porcelain crucibles to contain the subsamples placed in the furnace, and scales and balances for determining material weights.

Prior to each muffle furnace test, each of the 14 composite samples collected in the field was homogenized by tumbling and quartering and mixing with a stainless steel spatula. The thoroughly mixed sample was then divided into seven subsamples, each consisting of at least 300 grams. Six of the subsamples were subsequently treated in the muffle furnace and one was set aside for chemical analysis of the untreated waste material.

A total of 84 muffle furnace tests were performed on the 14 composited samples. For each composited sample, separate tests were conducted for each of the following sets of conditions:

<u>Residence Time</u> <u>(minutes)</u>	<u>Temperature</u> <u>(F)</u>
15	1,000
15	1,400
15	1,750
45	1,000
45	1,400
45	1,750

The above residence times and temperatures were selected so that incineration performance could be estimated over a range of conditions that might be employed in the primary combustion chambers of rotary kiln, fluidized bed, and infrared incinerators, which are under consideration for treating the contaminated soils and sediments. The temperatures and times were monitored and recorded periodically throughout the test period. When the prescribed residence time was reached at the target temperature, the subsample was removed from the furnace.

Each subsample was processed individually in the muffle furnace to preclude the possibility of cross contamination between different subsamples. During each muffle furnace test run, the furnace door was left ajar to permit some combustion to occur, thereby approximating conditions in an incinerator. In all cases, the subsamples were not compacted in the crucibles, but were left loose to enable oxygen to permeate the bulk of the waste material.

The following data were obtained for each muffle furnace test: volume and weight loss; visual observation of wastes and ash residues during and after thermal treatment; and chemical and physical analysis of the ash residues and untreated wastes. All subsample densities were measured using a "tap" density method. The measuring cup was tapped gently to allow the material to settle, but no attempt was made to pack the material. Measured subsample volumes and densities before and after thermal treatment were then recorded. At the end of each test, the subsample being processed was placed in an appropriate sample bottle and shipped to the project laboratory, Environmental Science and Engineering, Inc., for determination of

chemical properties. The untreated subsample portions from the 14 composite samples were analyzed for TCL BNAs and TAL metals. The subsample ash residues from each muffle furnace test run were analyzed for TCL BNAs and TAL metals for comparison with the untreated samples. In addition, the ash residues were tested for TCLP metals and BNAs to determine whether any of the residues exhibited hazardous characteristics as defined under RCRA. The results of these tests and analysis of the test data are presented in Section 7.4.3. Volatile organic compounds were not included in the analyses because it is extremely unlikely that detectable levels of these compounds could have been retained in the wastes during heating to the temperatures used in the muffle furnace tests. At temperatures of 1,000°F and higher, the volatile compounds should be completely desorbed from the solid waste matrix.

#### 7.4.3 Results of Muffle Furnace Tests

The results of the muffle furnace tests are tabulated in detail in Appendix F. Tables F16 through F29 present the results from each of the 14 composited samples that were used in the muffle furnace tests. In each of these tables, the following parameters are presented for both the untreated soil and the ash residues remaining after the completion of the muffle furnace tests: concentrations of metals, concentrations of semivolatile organic compounds, and percent moisture. In addition, the following parameters are also presented for the ash residues: the temperature and residence time employed for the muffle furnace tests; the volume change and weight loss resulting from the thermal treatment of the soil; densities before and after the muffle furnace tests; and observations related to the appearance of the ash, the tendency of the ash to agglomerate, and the performance of the test.

Each of the 14 composited samples employed in the muffle furnace tests is identified in terms of one of the following sample data groups:

MFH-SUSN = Horizontal composite of shallow soils from Upper Site and Northeast Tank areas

MFH-SLTA = Horizontal composite of shallow soils from Land Treatment Area

MFH-MLTA	=	Horizontal composite of mid-depth soils from Land Treatment Area
MFH-DLTA	=	Horizontal composite of deep soils from Land Treatment Area
MFV-SB08	=	Vertical composite of soils from boring SB08
MFV-SB10	=	Vertical composite of soils from boring SB10
MFV-SB11	=	Vertical composite of soils from boring SB11
MFV-SB12	=	Vertical composite of soils from boring SB12
MFV-MW28	=	Vertical composite of soils from boring MW28
MFH-SCTA	=	Horizontal composite of shallow soils from Containment Area
MFH-MCTA	=	Horizontal composite of mid-depth soils from Containment Area
MFH-DCTA	=	Horizontal composite of deep soils from Containment Area
MFH-SSIA	=	Horizontal composite of shallow soils from Spray Irrigation Area
MFH-SSTR	=	Horizontal composite of shallow sediments from Streambed of west tributary

The column designations in these tables are defined as follows:

- U = Untreated sample
- A = Muffle furnace temperature of 1,000°F and residence time of 15 minutes
- B = Muffle furnace temperature of 1,400°F and residence time of 15 minutes
- C = Muffle furnace temperature of 1,750°F and residence time of 15 minutes
- D = Muffle furnace temperature of 1,000°F and residence of 45 minutes

**E = Muffle furnace temperature of 1,400°F and residence time of 45 minutes**

**F = Muffle furnace temperature 1,750°F and residence time of 45 minutes**

The results of the TCLP tests performed on the ash residues from the muffle furnace tests are tabulated in Tables F-30 through F-43. Data are presented for metals and semi-volatile compounds that have applicable TCLP regulatory limits. The same nomenclature described above for the muffle furnace test results is employed for the TCLP test results.

The muffle furnace and TCLP test results are discussed further in the following sections.

**7.4.3.1 Organic Residues in Ash.** The total concentrations of semi-volatile compounds are summarized in Table 7-8 for both the untreated soil samples and the ash residues from each of the muffle furnace tests.

As shown in Table 7-8, detectable levels of organic residues remained in 10 of the 14 soil samples that were treated at the lowest temperature (1,000°F) and shortest residence time (15 minutes) employed in the muffle furnace tests. For four samples (MFH-DLTA, MFV-SB08, MFV-SB10, and MFH-MCTA), hazardous organic contaminants were reduced to non-detectable levels even at these lease severe test conditions. For the other 10 samples, increasing the furnace temperature to 1,400°F, while maintaining the residence time at 15 minutes, resulted in the elimination of any detectable levels of hazardous organic constituents in the ash. Successful treatment was also achieved by increasing the residence time to 45 minutes at all temperatures tested, including the 1,000°F operating temperature. The only two exceptions were what appear to be anomalous data points (Ash Sample E of MFH-SLTA and Ash Sample F of MFV-SB08) where BNAs were detectable after 45 minute runs at 1,400°F and 1,750°F, respectively. In both of the anomalous cases, phthalates were the organic compounds detected, which are common laboratory artifacts.

TABLE 7-8

## Summary of Muffle Furnace Test Results - Organic Compounds

Sample Data Group*	Total Concentration of Semi-Volatile Compounds, $\mu\text{g}/\text{kg}$ **						
	U	A	B	C	D	E	F
MFH-SUSN	700	1,900	0	0	0	0	0
MFH-SLTA	90,900	17,860	0	0	0	150	0
MFH-MLTA	45,462	240	0	0	0	0	0
MFH-DLTA	750	0	0	0	0	0	0
MFV-SB08	1,090	0	0	0	0	0	1,900
MFV-SB10	1,450	0	0	0	0	0	0
MFV-SB11	71,800	72	0	0	0	0	0
MFV-SB12	13,030	120	0	0	0	0	0
MFV-MW28	19,743,000	515,000	0	0	0	0	0
MFH-SCTA	41,610	80	0	0	0	0	0
MFH-MCTA	25,410	0	0	0	0	0	0
MFH-DCTA	907,000	920	0	0	0	0	0
MFH-SSIA	2,200	150	0	0	0	0	0
MFH-SSTR	6,740	1,550	0	0	0	0	0

\* See Section 7.4.3 for definition of Sample Data Groups.

\*\*Muffle furnace test conditions: U = untreated soil; A = 1,000°F, 15 minutes; B = 1,400°F, 15 minutes; C = 1,750°F, 15 minutes; D = 1,000°F, 45 minutes; E = 1,400°F, 45 minutes; and F = 1,750°F, 45 minutes.  
 $\mu\text{g}/\text{kg}$  = micrograms per kilogram.

The above results indicate that a furnace temperature of 1,400°F and a residence time of 15 minutes, or a furnace temperature of 1,000°F and a residence time of 45 minutes should be adequate to reduce hazardous organic constituents in all soils at the SMWP site to nondetectable levels. For some soils at the site, a furnace temperature of 1,000°F and residence time of 15 minutes may be adequate to reduce cPNA concentrations to below the cleanup criteria. As stated previously, 10 of the 14 samples run at 1,000°F and 15 minutes in the muffle furnace contained measurable concentrations of organics. However, as shown in Table 7-9, only 2 of these 10 samples contained cPNAs above the threshold limit of 1,000 µg/kg. If a threshold limit of 10,000 µg/kg total cPNAs is used, only one of the 10 samples failed to meet the criteria. Although the data is difficult to correlate, it appears that cPNAs are reduced by roughly one order of magnitude or more under the operating conditions of 1,000°F and 15 minutes. Therefore, there may be an opportunity to process some of the lesser contaminated soils on site under this less severe operating conditions.

**7.4.3.2 Volatilization of Metals.** The volatilization of metals from wastes treated in an incinerator can affect the design of the incinerator's air pollution control system. The muffle furnace test data were therefore analyzed to estimate the volatilization of metals from each of the soil samples treated in the muffle furnace.

The metals data presented in Appendix F are summarized in Table 7-10. The total concentrations of metals in the untreated soils and the difference between the total metal concentrations in the untreated soil and the ash residues from the muffle furnace tests are presented in Table 7-10. It can be seen from Table 7-10 that the patterns in the metals data are generally not consistent. In many cases, increasing the temperature and/or the residence time appeared to result in an increase in the ash metals concentrations in comparison to the untreated soils, rather than the expected decrease that would result from the volatilization of metals from the soils. For 43 of the 84 muffle furnace tests conducted in this program, the total metals concentrations

**TABLE 7-9**

**Summary of cPNA Removal for Samples Having Dectable BNA's Following 1000° F  
and 15 Minute Muffle Furnace Runs**

<u>Muffle Furnace Sample Number</u>	<u>cPNA Concentration Untreated Sample</u>	<u>cPNA Concentration Treated Sample</u>
MFH-DCTA	117,000	BDL
MFH-MLTA	10,490	BDL
MFH-SCTA	25,540	80
MFH-SLTA	29,000	7,900
MFH-SSIA	2,200	150
MFH-SSTR	2,060	590
MFH-SUSN	610	BDL
MFV-MW28	2,446,000	166,000
MFV-SB11	26,140	BDL
MFV-SB12	6,030	BDL

Notes:        Units in  $\mu\text{g/kg}$   
              BDL - Below detection limit

TABLE 7-10

## Summary of Muffle Furnace Test Results - Metals

Sample Data Group*	Total Concentration of Metals, mg/kg**						
	<u>U</u>	<u>U - A</u>	<u>U - B</u>	<u>U - C</u>	<u>U - D</u>	<u>U - E</u>	<u>U - F</u>
MFH-SUSN	19,685	8,688	-420	2,463	5,007	1,328	15,889
MFH-SLTA	21,850	4,831	-4,363	5,797	-3,075	-5,409	18,369
MFH-MLTA	26,012	1,777	-5,631	350	-5,769	-6,495	18,057
MFH-DLTA	14,416	1,614	-2,133	-89	-686	-4,967	9,704
MFV-SB08	7,103	-371	-5,308	-1,822	-3,467	-5,597	5,435
MFV-SB10	24,404	362	530	4,642	14	500	9,448
MFV-SB11	11,535	4,301	-4,522	1,470	-3,708	-4,445	9,594
MFV-SB12	39,357	-677	-4,317	10,953	-5,535	3,596	33,931
MFV-MW28	26,939	1,079	-4,138	6,387	-2,559	1,160	22,115
MFH-SCTA	26,055	253	-9,517	13,770	-8,187	-12,792	14,268
MFH-MCTA	14,596	-717	-7,536	2,697	-5,633	-8,122	4,707
MFH-DCTA	24,959	-1,083	-12,004	-10,004	-2,284	-5,943	-108
MFH-SSIA	25,970	-3,571	-3,900	-1,086	-13,870	-12,920	17,851
MFH-SSTR	44,612	19,578	323	15,831	4,347	-6,582	37,909

\* See Section 7.4.3 for definition of Sample Data Groups.

\*\*Muffle furnace test conditions: U = untreated soil; A = 1,000°F, 15 minutes; B = 1,400°F, 15 minutes; C = 1,750°F, 15 minutes; D = 1,000°F, 45 minutes; E = 1,400°F, 45 minutes; and F = 1,750°F, 45 minutes.

U - A, U - B, U - C, etc., represent the difference between the total metals concentration in the untreated soil and the ash residue from Muffle Furnace Test A, B, C, etc., respectively.

mg/kg = milligrams per kilogram.

in the ash actually exceeded the corresponding metals concentrations in the untreated soils.

In general, increasing the furnace temperature from 1,000°F to 1,400°F and/or the residence time from 15 to 45 minutes did not appear to result in significantly increased volatilization of metals. However, for residence times of both 15 minutes and 45 minutes, increasing the temperature from 1,400°F to 1,750°F did result in substantially reduced levels of metals in the ash, which is indicative of increased volatilization of metals. However, because the feed concentration of toxic metals is low and a temperature of 1,750°F is not needed to volatilize the organic contaminants, no problems are anticipated with metals emissions from an onsite incinerator.

**7.4.3.3 Ash Toxicity Characteristics.** The detailed TCLP test data presented in Tables F-30 through F-43 are summarized in Table 7-11. The maximum TCLP leachate concentrations measured for any of the 14 sets of data in Appendix F are presented in Table 7-11 for each of the six muffle furnace test conditions employed in this program. The maximum leachate concentrations are also compared to the corresponding TCLP regulatory levels in Table 7-11.

As shown in Table 7-11, no organic compounds were detected in the leachate in any of the TCLP tests. Arsenic, barium, cadmium, chromium, and mercury were detected in one or more of the TCLP tests. In no case did any of these metals exceed five percent of the corresponding TCLP regulatory limit. Examination of the data in Appendix F and Table 7-11 also indicates that the temperatures and residence times employed in the muffle furnace tests did not appear to have a major effect on the TCLP test results.

The TCLP test results discussed above indicate that ash resulting from the incineration of soils at the SMWP site will be non-hazardous according to applicable TCLP regulatory criteria, as long as reasonable temperature and residence time conditions are employed for the incinerator. If this conclusion is confirmed during the trial burn and subsequent operation of the incineration system, the ash will be disposed of on site by backfilling the areas where the soils have been excavated.

TABLE 7-11

## Summary of Muffle Furnace TCLP Test Results

	<u>Maximum Leachate Concentrations, <math>\mu\text{g/l}</math></u>						<u>TCLP Regulatory Level, <math>\mu\text{g/l}</math></u>
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	
<u>Metals</u>							
Arsenic	BDL	BDL	BDL	BDL	BDL	221	5,000
Barium	360	539	405	409	417	302	100,000
Cadmium	4.2	BDL	BDL	BDL	BDL	3.2	1,000
Chromium	BDL	45.5	BDL	217	13	BDL	5,000
Lead	BDL	BDL	BDL	BDL	BDL	BDL	5,000
Mercury	BDL	BDL	BDL	0.2	BDL	BDL	200
Selenium	BDL	BDL	BDL	BDL	BDL	BDL	1,000
Silver	BDL	BDL	BDL	BDL	BDL	BDL	5,000
<u>Semi-Volatiles</u>							
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	7,500
2,4,5-Trichlorophenol	BDL	BDL	BDL	BDL	BDL	BDL	400,000
2,4,6-Trichlorophenol	BDL	BDL	BDL	BDL	BDL	BDL	2,000
2,4-Dinitrotoluene	BDL	BDL	BDL	BDL	BDL	BDL	130
2-Methyl Phenol	BDL	BDL	BDL	BDL	BDL	BDL	200,000
3-Methyl Phenol	BDL	BDL	BDL	BDL	BDL	BDL	200,000
4-Methyl Phenol	BDL	BDL	BDL	BDL	BDL	BDL	200,000
Hexachlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	130
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	BDL	500
Hexachloroethane	BDL	BDL	BDL	BDL	BDL	BDL	3,000
Nitrobenzene	BDL	BDL	BDL	BDL	BDL	BDL	2,000
Pentachlorophenol	BDL	BDL	BDL	BDL	BDL	BDL	100,000
Pyridine	BDL	BDL	BDL	BDL	BDL	BDL	5,000

Muffle furnace test conditions: A = 1,000°F, 15 minutes; B = 1,400°F, 15 minutes; C = 1,750°F, 15 minutes; D = 1,000°F, 45 minutes; E = 1,400°F, 45 minutes; and F = 1,750°F, 45 minutes.

BDL = Below detection limits.

TCLP = Toxicity characteristic leaching procedure.

$\mu\text{g/l}$  = micrograms per liter

7.4.3.4 Physical Characteristics of Ash Residues. Observations of the ash by Ogden Environmental Services test personnel indicate that some degree of sintering occurred as a result of the thermal treatment of most of the soil samples used in this program. Sintering was recorded as varying from "light" to "heavy" or "gross," and some samples were reported to have formed monolithic masses in the test crucible. In all cases, the sintered material was easily broken up using a spatula or mixing knife. The tendency for the ash to agglomerate is expected to be much less in a dynamic fluid bed or rotary kiln incinerator, as compared to the static conditions that existed during the muffle furnace tests.